HE FIRST $50,000,000 by LOUIS JOHNSON
ASSISTANT SECRETARY OF WAR

POPULAR AVIATION

GUST
25c

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A fleet of "105" Demonstrators is now on tour. Deliveries are rapidly being made to all parts of the Country. Won't you inspect and fly the "105" if you plan to buy a fine airplane this year. Convince yourself that all we say about the "105" is true.

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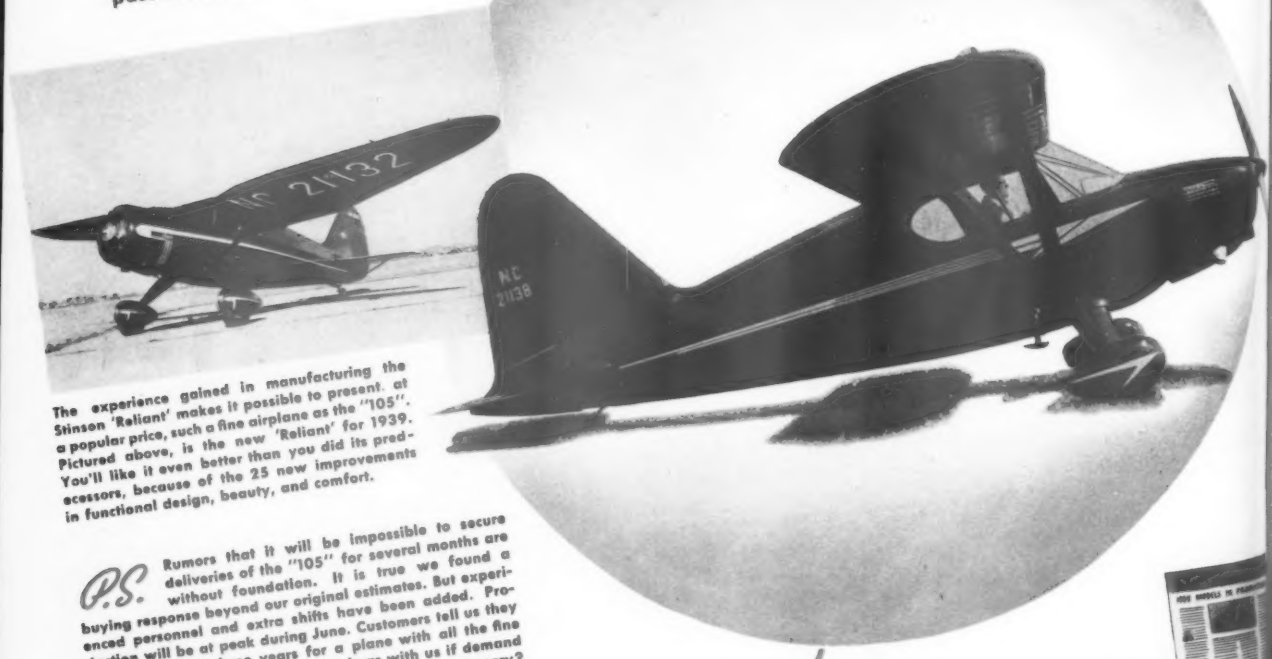

The experience gained in manufacturing the Stinson 'Reliant' makes it possible to present, at a popular price, such a fine airplane as the "105". Pictured above, is the new 'Reliant' for 1939. You'll like it even better than you did its predecessors, because of the 25 new improvements in functional design, beauty, and comfort.

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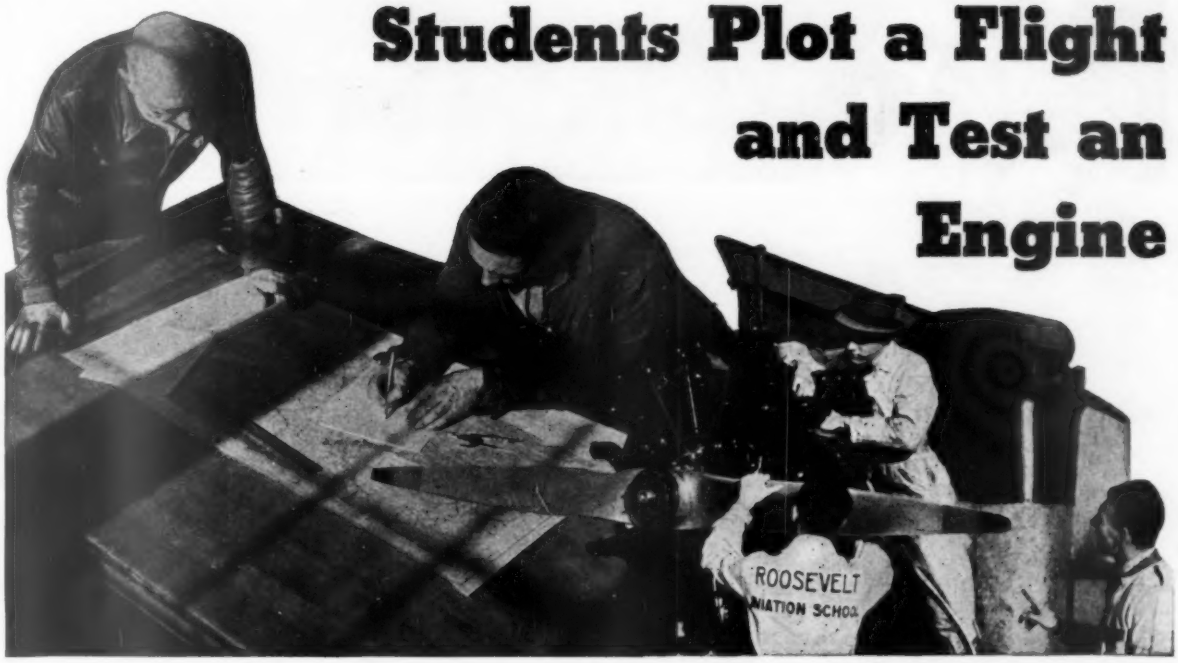
Students Plot a Flight and Test an Engine



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Preparatory to his first cross-country flight, the student is required to lay out his course. His work, under the supervision of an Instructor, is checked at every point. *Result:* A successful flight with complete *confidence* on the part of the student.

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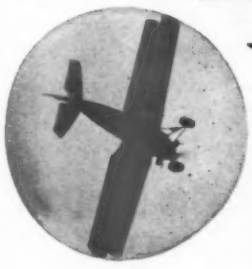

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P.A. AUGUST, 1939

The Birdmen's Perch

Pilots just aren't the men they used to be when we were young. In those days a flyer'd as soon lie as fly. Wasn't a one wouldn't have taken it as a matter of honor hardly to rest till he got one of our Whopper Diplomas. Now lying's a lost art among modern practitioners. Or is it? If you think you can qualify to compete with the old-timers, send in your most hyperbolous fabrication in re Gulf Aviation Gas to:

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips,"
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THE EDITOR'S MAILBAG

A novel club seems to have sprung up among our contribs. It's called Stuffing-Answers-to-Allegedly-Hard-Projection-Problems-Down-the-Editor's-Throat, Inc. We got so many to the last one that we're taking a month off to lick our wounds and dream up a jim-dandy of a rip-snorter of a lollapalooza.

In the meantime here are a few of the club members who've scored on us lately: W. J. "too easy" Brown; Johnny "this time I got it without my instructor" Childs; Howard J. "kindergarten stuff" Ide; Robert J. "quit kidding us" Page; Bob "get one hard" Newill; Lyle E. "this may start a feud" Dambruch; Bill Hartley; Harmon "they're getting easier" Van Winkle; Walter "much easier" Thomson; Clarence Thomas; Pvt. Edward A. Kresan; Frank Commisso; P. Morotchic; Walter Dinteman; W. Blake "is somebody's fez red!" Henderson; E. N. Grimwood; E. Dennis; Bill Corbett and Bob "How about something hard?" Dickey; Norman E. Schmidt; and J. B. "the printed matter . . . might have led one to think it was rather difficult" Trenholm.

Laugh while you may, palsies, we're turning on the heat in August.

Or else throwing in the sponge!

CONCENTRATE

Remember when you watched your mother making ice cream back in barefoot days? While the freezer was turning you probably wondered how just a few drops of vanilla could flavor a whole freezerful. The answer, of course, was that the vanilla extract was *concentrated*.

As you probably guessed, this is leading up to our Gulfpride Oil. The point we're making is that, in comparison with other oils, Gulfpride is *concentrated*. Gulf's own Alchlor process—used in addition to conventional methods—digs down deeper into the 100% Pennsylvania—removes still more dirt and sludge. *The result?* There's more lubricating power per drop in Gulfpride. And that means more protection for your airplane motor.

However, for use in making ice cream, we'll still take vanilla.

FANTASTIC FINANCE

Three pilots we know went to a hotel on Friday.

On Sunday afternoon they called for their bill which was $30. They each paid $10 and went upstairs to pack.

In filing the bill, the cashier discovered

that it should have been $25. So he sent a bellboy up with a $5 rebate.

On the way, the bellboy decided the pilots would never know the difference, and he pocketed $2. The remaining $3 he split among the pilots.

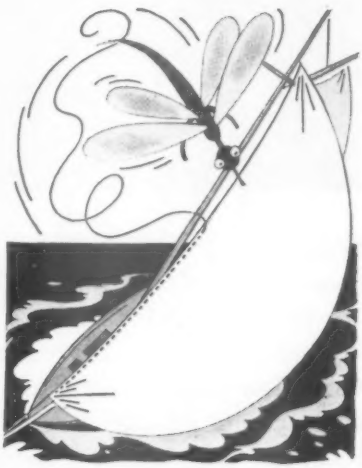
This $1 each, subtracted from the original $10 each had paid, left each out $9.

3 x $9=$27. $27 + the $2 taken by the bellboy=$29.

The pilots originally paid $30, so what happened to the other dollar?

Don't get too mad, boys, if you can't figure this out. We couldn't either. Send your idea of what's wrong to T. W. T. and we'll break the official explanation to you as gently as possible.

THIS MONTH'S WHOPPER



Dear Major:

Norman McEwan's experience with Gulf Aviation Gas and mosquitoes might seem implausible to some. But not to me.

Down East here in Gloucester one of the boys has a pet darning needle (some calls 'em dragon flies) that he rents out to yachtsmen. On ordinary gas it's all the poor beastie can do to finish a light canvas sail for a 10-foot dinghy in an afternoon.

But on one swig of Gulf Aviation Gas that flying seamstress has been known to whip out a balloon spinaker for a Class J sloop in 10 minutes . . . *hemstitching all the way!*

'Struth,

Dapper Dan Shea

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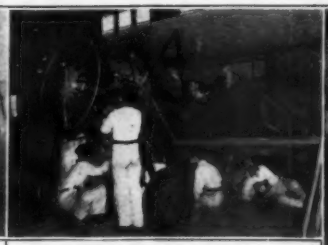
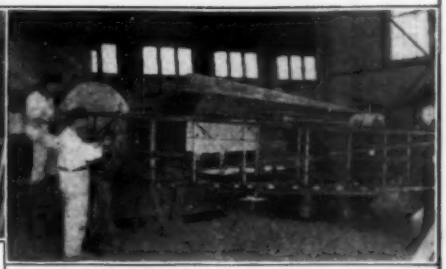


Major Overhaul



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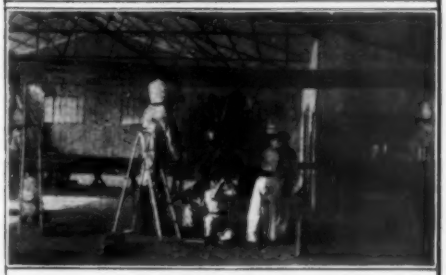

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Doping Wing

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WE shouldn't like to think that the Civil Aeronautics Authority has just overlooked the 1939 crop of aeronautical lunatics currently trying to fly the Atlantic in all sorts of airplanes—most of them never intended for non-stop flights of more than 300 miles. We know, of course, that the C.A.A. refuses to grant permission for such flights and, if one of those crack-brained pilots ever gets back to this country alive he faces a stiff fine. At least, that's what is on the books.

It seems a bit odd, though, that that one pilot had but to get a Swedish license made out for his American ship in order to take off for Europe unmolested. Apparently everyone in the United States knew what he was up to except the C.A.A. The fact remains he flew out to sea and hasn't been heard of since. We're inclined to wonder why the C.A.A. couldn't have gotten the Newfoundland government to prevent his take-off.

Then there was that young fool who set out across the 3,500 miles of Atlantic ocean in a lightplane that couldn't even fly non-stop from Chicago to New York normally. He just brazenly defied the law and didn't bother working out a "disguise" for the flight. He, like the first fellow we mentioned, undoubtedly is dead.

There are more such flights pending, we understand. We think the C.A.A. should make every effort to stop them. Not that all record attempts should be banned; handled correctly there is a definite place for even transatlantic flights. But rattle-brained, death-defying stunt flights are injurious to the aviation industry and must be stopped. We wonder whether the C.A.A. is trying its hardest to put a stop to them. After all, they did make a rather shabby showing in connection with Corrigan's flight. They suspended his license—while he was aboard an ocean liner.

* * *

HAD an interesting time the other week-end. Started with a flight from Chicago to New York in the DC-4. We wouldn't have missed that, of course, but it was really monotonous from the standpoint of sheer flying. The DC-4 is huge, comfortable and quiet but, from the passenger's standpoint, is just an enlarged DC-3. Personally, we got quite a kick out of the novel take-offs and landings with the ship's tricycle landing gear. Then from New York we

(*Continued on page* 82)

POPULAR AVIATION

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Cover Photograph: Randolph Field instructor and student, by Ivan Dmitri

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The newspapers are full of the proposed United States national defense aviation expansion program now just getting under way. Tremendous plans are being made for capacity production, WHICH MEANS TRAINED MEN WILL BE IN DEMAND AND AT A PREMIUM. Aviation is a highly specialized business and there is no chance for advancement for the untrained or poorly trained man, since he is the last one in aviation to get a job and is the first one to lose it. Opportunity is positively hammering at your door. There never was such a chance in aviation for you—there may never be another such chance.

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PA-8

The First $50,000,000

By LOUIS JOHNSON
Assistant Secretary of War

The author (left) and President Roosevelt are shown discussing with Lieut.-Comm. Andrew Crinkley the transcontinental flight about which Crinkley wrote in the March issue of POPULAR AVIATION ("Rush Order!").

"HERE is $50,000,000. Go out and buy the Army some airplanes. Don't buy too many of any one kind. Don't spend too much of the money in any one place."

Not in these exact words, nor in any such tone of levity but nevertheless, in substance, that was the purport of the message sent by the President to the War Department on the afternoon of April 26, 1939. He had signed the bill passed by Congress appropriating an immediate expenditure of $50,000,000 for planes, engines and accessories.

Let us analyze the implications of his message more closely. First there is the money itself. How we needed that $50,000,000 for our Air Corps on that day! Congress had authorized us to build more planes until we would have 6,000, but authorizing planes and appropriating the money with which to buy them are separate considerations. Our appropriations for the Air Corps for the fiscal year ending June 30, 1939, already had been obligated or allotted. We would have no more money with which to buy planes until July 1, 1939, when the 1939-1940 fiscal year would begin.

In the meantime, large airplane plants were lying idle. There were not enough jobs to go around for all the airplane mechanics. Factory owners could hardly afford to pay wages to retain their skilled workers merely in the hope that they might win in a stiff competition some Government contracts after July 1.

The War Department placed the facts before the President. The President informed Congress. Congress did the rest. We got the $50,000,000, virtually an advance on our expected 1939-1940 appropriations.

We, therefore, were not exactly surprised when the President signed the bill on April 26. In fact, we had anticipated it. We had been studying latest developments and contemplating what we would do when and if the money arrived. The officers of the Air Corps knew exactly what they wanted in the way of type, quality, and number and had facts, figures, and experience to back up their selections. When the authority to spend the $50,000,000 was received, we were all set "to go out and buy the Army some airplanes."

The first day, I spent more than nineteen and one half million dollars and I was especially careful not to "buy too many of any one kind and not to spend too much of the money in any one place."

First, I signed a contract for $2,880,000 with the Consolidated Aircraft Corporation of San Diego, California, for the purchase of some heavy four-engined

$ This article is by a well-known American who was simply handed $50,000,000 and told to buy some airplanes for the Army Air Corps. By the time you read this Mr. Johnson probably will be preparing to spend another hundred million or so for air defense. $

bombardment airplanes, type B-24. Our four-engined bombers (Boeing) that we sent to South America on a good will trip recently not only won the admiration and the respect of our Latin American neighbors, but also brought back with them rich dividends in warm friendship and better understanding.

It is the consensus of aviation authorities throughout the world that our *Flying Fortresses* are in a class by themselves. They maintain speeds in excess of 250 m.p.h. Each plane mounts five machine guns. Each carries a crew of six to nine men. The members of the crew have been so trained that they can freely exchange assignments among themselves. This training comes in good stead on long trips.

An air fleet made up wholly of heavy bombardment planes would be out of balance. The need for pursuit ships is self-evident. I went out, therefore, and bought some pursuit airplanes, single-engined, type P-40 from the Curtiss Airplane Division of the Curtiss-Wright Corporation, New York City. I signed contracts for almost $13,000,000 worth of these ships.

The Army Air Corps was unusually enthusiastic about this purchase. The P-40 can develop speeds considerably in excess of 300 m.p.h. It is an internally braced monoplane of all-metal construction except for the control surfaces which are fabric-covered. The engine is an Allison, liquid-cooled. The landing gear is retractable into the wing. It is armed with two machine guns and carries oxygen equipment for operation at extremely high altitudes.

Continuing my shopping on that day, I then signed a contract with the Lockheed Aircraft Corporation of Burbank, California, for $2,180,728 for the purchase of some pursuit interceptor, two-engined airplanes, type YP-38. This type of plane has been developed but recently and is designed to intercept and attack enemy aircraft, particularly heavily armed bombers. It is good for speeds of considerably more than 350 m.p.h. It is powered with Allison engines and has a tricycle type landing gear.

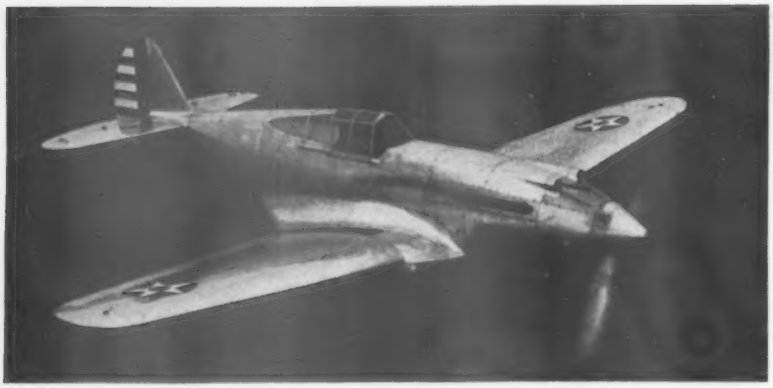
I found that the Bell Aircraft Corporation, Buffalo, New York, had exactly what we needed in the way of a pursuit interceptor plane, single-engined, so that corporation got a contract for $1,073,445.

I finished my day's work with an order for $528,749 to the Beech Aircraft Corporation of Wichita, Kansas, for some photographic airplanes. The Beech ship is an all-metal, three-place, two-engined, low-wing monoplane and is designed to carry two aerial mapping cameras in tandem. It is especially built for rapid and accurate photographic mapping of

Almost a cool $1,000,000 went to Seversky alone for "an unannounced number" of fighters identical with that above. They are a refinement of the P-35, designated YP-43.

First of the American interceptor fighters to be purchased by the Army Air Corps is the Bell P-39 for which the author awarded a contract amounting to $1,073,445.

A converted model of this twin-engined Beechcraft airliner has been ordered for use as a photographic ship. Number ordered is unknown but the contract was for $528,749.



Curtiss' powerful P-40 apparently appealed to the Army for the author awarded a juicy contract for almost $13,000,000 worth of these ships. The engine is a 2,000 h.p. Allison.

Fattest contract of all went to the already well-stocked Douglas plant. $15,000,000 worth of these attack-bombers was ordered. This model resembles that bought by France.

large areas. It is so designed as to afford the photographic observer and the pilot maximum possible visibility.

The impetus to aviation given by these contracts were felt in all parts of the country. The plants in California, New York and Kansas that won the primary contracts were not the only beneficiaries. Sub-contractors for parts will get some of the business. Basic industries that manufacture the materials to build the planes and their accessories will also reap advantages from the government orders.

Since April 26 we have continued our buying activities. We bought aircraft camera assemblies and camera filter units both from the Fairchild Aerial Camera Corporation, Jamaica, Long Island, and the Bruening-Winans Corporation, Rochester, New York. We obtained Parachute silk from the Cheney Brothers in Manchester, New Hampshire. We secured tow target assemblies from the Apple Manufacturing Company of Dayton, Ohio. We purchased spare parts for engines from the United Aircraft Corporation, Pratt and Whitney Aircraft Division, East Hartford, Connecticut. We gave the Allison Engineering Corporation of Indianapolis, Indiana, a contract for approximately $15,000,000 for the purchase of engines for installation in pursuit and interceptor pursuit airplanes.

On the very day I was asked to write this article for POPULAR AVIATION, I awarded a contract totaling almost $1,000,000 for a lot of Seversky YP-43 airplanes—all metal, low-winged, single-engined, single-seater monoplanes. The YP-43 is the last word in streamlining. We bought just a few for service tests and hope that we will be able to get from them speeds well in excess of 350 m.p.h. To add to the efficiency of the pilot and to protect him from the intense air blast incident to such high speeds, the YP-43 is provided with an enclosed cockpit. It carries oxygen and other devices to facilitate operation at high altitude.

This novel, twin-engined Lockheed fighter also appealed to the author, for a contract totaling $2,180,728 was awarded for this YP-38. This is another interceptor fighter.

The order that gave me unusual satisfaction was the one I awarded to the Douglas Aircraft Company of Santa Monica, California, for $15,000,000 for the production of a new design of an attack bomber. There was ample reason for this state of mind.

The responsibilities of the procurement program which would, before its completion, practically rearm our air force was thoroughly appreciated. An intensive survey had to be made to establish a standard of efficacy in the air that would justify the heavy expenditures demanded. Standards in advance of certain types of planes then in existence were indicated. Specifications for these, pertaining particularly to the field of attack bombers, were carefully worked out. In the meantime opportunity was offered to sell some of our late models abroad. There could be no possible objection to this since it is quite obvious to anyone who studied aviation that foreign markets for our planes facilitate production, strengthen our industry, help maintain labor and assure a healthy flow of business. Foreign trade in airplanes should be encouraged.

Obviously the foreign buyer does not want second-rate material and there was apprehension at times in some quarters that, due to the high standard of planes we were selling, we perhaps might be too generous. However, we knew what we were to demand from the forthcoming competition for our own production and the apprehension did not extend to the War Department.

Of this new attack bomber that won the $15,000,000 order, Major-General Henry H. Arnold, Chief of the Air Corps, says, "This plane has a better performance than any comparative airplane in production or in service anywhere in the world today."

In connection with the Congressional Hearings on the subject of the foreign sales a humorous incident took place which may now be repeated. When called before the Committee, I promised to withhold from the members no secrets. As a precaution, however, I asked that no stenographic record be made of my remarks. The members of the Senate Committee quite readily agreed.

I was well along in my discussion when I suddenly noticed someone at the far end of the table taking notes. I was greatly embarrassed, and stopped the proceedings. I politely intimated to the members of the Committee that perhaps there had been a breach of faith. To my surprise, Major-General Arnold, Chief of the Air Corps, volunteered that the person taking the notes was his own stenographer, working under his orders. The joke was on me. The Committee members enjoyed it at my expense.

(*Continued on page* 64)

HARASSERS

Latest British dive-bombers are these Blackburn "Skuas". They are standard flight equipment aboard aircraft carriers.

NEWS HAWKS

By DORIS AHNSTROM

Photographs copyrighted by the New York Daily News

An airplane roars down over the scene in a streaking sideslip, a camera clicks and the New York Daily News has covered its story in the modern way.

"CALLING WREE, Newark. Calling WREE, Newark."

"WREE. Okay, go ahead."

"NC-2239 reporting flight plan. Washington, D. C. Weiss, pilot. Cruising 150: 6,000 feet. Departure 11:15 A. M. Estimate time arrival 2 P. M. NC-2239."

"Stand by, NC-2239."

"Okay."

"WREE calling NC-2239, NC-2239."

"NC-2239 reporting. Go ahead."

"Flight plan okay. All clear. Go ahead."

And the trim white plane noses toward another story that, in a few hours, will grace the pages of the New York *Daily News*.

In the last six years the *Daily News* planes have become as familiar a sight at the scene of the "story" as gulls hovering over a ship in the harbor. The introduction of these planes, however, goes back more than six years. This newspaper that now boasts the largest circulation of any newspaper in the country first started using the airplane in its news-gathering and picture-taking in 1930. Then, chartering a plane for its service, the *Daily News* relied upon its only flying photographer, Herbert McCory, for all pictures. Today, each of the staff of 26 photographers has had time in the air taking the pictures the *Daily News* prints. With few exceptions, practically every reporter has been

The News' two aces are George Weiss (left) and famed veteran Duke Krantz.

flown at one time or another to a distant point to get the facts that 3,000,000 readers want.

One afternoon in 1933 Captain Joseph Medill Patterson, a pilot in his own right, looked over the expense sheets that three years of chartering planes had placed before him. Scanning the figures of performance and cost of various airplanes, he decided the *Daily News* ought to own its own plane. He chose an Ireland *Privateer*. Since that time, the paper has owned a Stinson and four Wacos. Today out at Roosevelt Field at Mineola, Long Island, the hangar holds two white Wacos, each bearing the *Daily News* insignia on its fuselage. No plane is kept more than two years and the purchase of a new ship is so arranged that the *Daily News* has a new one in its hangar each year. With the 1938 Waco still in perfect condition the 1937 Waco will, in a month or so, be turned in for a 1939 ship.

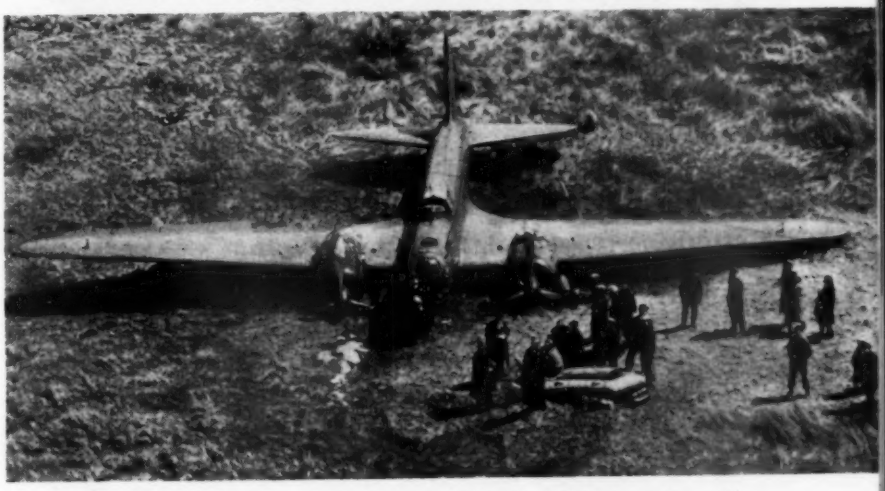
The term "newshawk", as reporters and photographers of the Fourth Estate are affectionately called, has at long last come into its own true sense of meaning. Retaining the attitude and now adopting the altitude of the hawk the newsmen and women are, strictly speaking, newshawks. His No. 1622 pencil in his pocket, his camera tossed into the rear seat of the plane, his pilot adjusting the compass, the 1939 reporter is ready to take-off in quest of the story for which his million readers are waiting.

What of the pilots that fly these *Daily News* planes? Duke Krantz and George Weiss are flyers of the Grade A variety and each boasts plenty of hours in his log book. Krantz' aviation experience dates back to 1922. In that year, after holding down a job with Uncle Sam's Post Office, Duke left his mail job to become famous as "Diavolo", wing-walker and parachute jumper of the Gates Flying Circus which featured an imposing list of pilots that included such men as Clyde Pangborn, Jack Ashcraft, Wilmer Stultz and Bill Brooks. It was while Duke was with this famed flying aggregation that he learned to fly, not by actual instruction but by careful observation when flying between towns. If some pilots are born flyers, Duke fits this category. He is more at ease in the air than Mister Average Man in his pet slippers.

In Syracuse, New York, in 1929 Duke, flying with Capt. Ives McKinney, broke the existing endurance record. The record had formerly been held by Majors Carl Spatz and Ira C. Eaker. Irony lifted its hand here for the same Major Spatz had refused, several years before, to approve Krantz' application for service with the United States Army Air Corps. The reason for such disapproval was that Krantz, still comparatively new to this country, did not speak the English language too well and Major Spatz felt that the Swedish lad would not make good Army material. It has been reported that the major, when given the name of his successor to the endurance record, was too stunned by the realization of his earlier mistake in judgment to make any comment.

The ensuing years took Krantz off barnstorming, flying charter work and

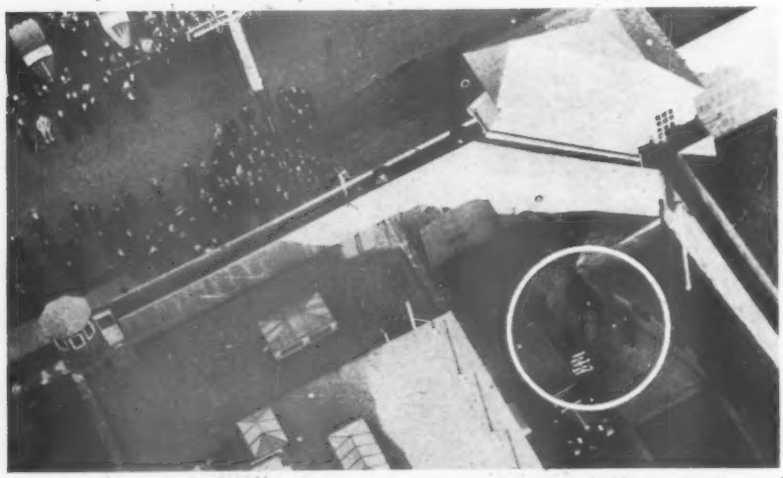
Duke Krantz flew a Daily News plane through a roaring gale, rain and fog eight miles off the coast of New Jersey to get these memorable shots of the burning Morro Castle.



This photograph of the end of a recent Moscow-to-New York flight is another world scoop credited to a News plane which flew to far-off Miscou Island for the picture.

Krantz also was responsible for this remarkable close-up photograph of a young mountain-climber killed in a fall. The ship was flown within 25 feet of the cliffs.

This is one of the two Daily News planes. These ships each fly about 500 hours per year. It is estimated that its entire aviation setup costs the News $30,000 annually.



This is the remarkable photograph of the removal of Hauptmann's body obtained through the ingenuity of Krantz. Notice crowd of newspapermen waiting outside gate.

When disaster strikes, the Daily News immediately dispatches a plane to the scene. Above is Hartford, Conn., taken in September, 1938, after going through a hurricane.

doing some airline flying. In 1932, Duke began his career of flying for the *Daily News*. Having been a pilot on several of the charter trips probably helped put Duke in the number one position for pilot for the *Daily News'* first privately-owned plane, the *Privateer*. Today, Duke flies the 1938 Waco, is the pilot for those photographers whose breath-taking close-up and angle shots of everything from fires to fan dancers appear on the pages of the *Daily News*.

George Weiss, the other half of the *Daily News* team, got his early training with the Army Air Corps. After getting his first flying lessons in 1919 from Lawrence Sperry, George moved into quarters with the Army Flying School at Brooks Field, later graduating at Kelly Field. Following the curriculum of most pilots at that time, the red-headed Army boy barnstormed around the country for a few months and then went into active Army duty at Mitchel Field on Long Island.

In 1926, Weiss took a job with the Fox Film Corporation and with them learned how to kick a photographic ship around into position for aerial shots. With such experience in his log book, he stepped into a pilot's position with United Air Lines and later with the *Daily News*. Weiss has flown for Captain Patterson's organization since 1934.

With either of these two pilots, Krantz and Weiss, the *Daily News* has been able to get pictures that many other metropolitan newspapers have not. Both men have accumulated approximately 6,000 flying hours and plenty of experience in flying under any and all conditions.

Because the news stories often break when the weatherman has on his heavy overcast glasses, the ships that fly for news and pictures have to be equipped to fly under any condition. For this reason, the equipment for instrument flying that the *Daily News* ships carry is exceeded only by the airliners. In addition to the standard instruments each plane is equipped with a radio transmitter, two receivers and a radio compass operating on three different frequencies and with a range of over a hundred miles under all conditions. An artificial horizon, directional gyro, a sensitive altimeter, an air speed indicator, turn and bank indicator, direction finding equipment and life preservers and parachutes keep the pilots and working press on the safe side of the ledger.

The job of keeping planes and equipment in perfect working order falls to Andy Servini, an Early Bird-man and the man with probably as much experience on his chart as any other man active in aviation today. The fact that the ships have never been held up by mechanical trouble is the best evidence of the care given them. Certainly flying a landplane miles out over the ocean, zooming down over a fire that is so hot it almost melts the camera, and landing on anything from a cow pasture to an ice floe is not exactly petting a ship when it comes to treatment.

Because the *Daily News* is a picture newspaper, it is primarily interested in getting the first pictures and the best pictures. The cost of this endeavor runs into five

figures for the aviation side alone. Because the governing body of the newspaper prefers not to make known the actual figures as regards cost of operation, etc., of their planes, we might pull the puzzle apart ourselves and get an approximation.

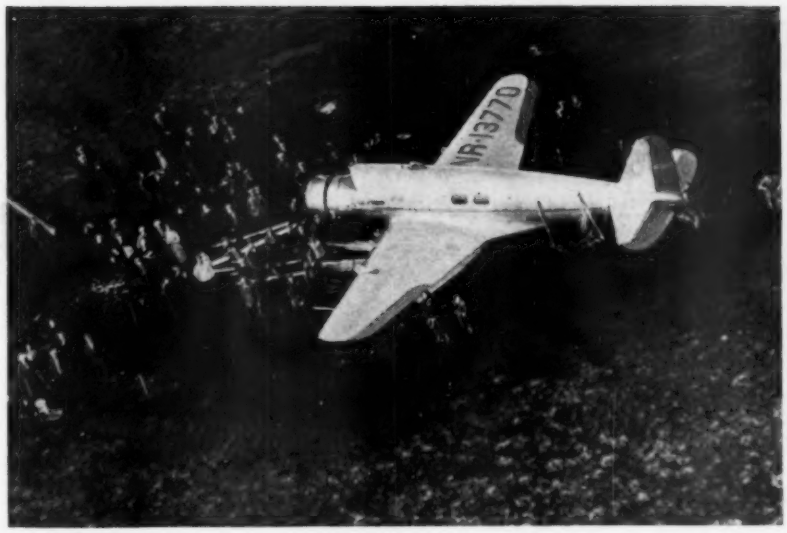
The two ships each fly about 500 hours a year. Figuring on the basis of ships each costing in the vicinity of $7 an hour to fly, we can assume that the gasoline and oil alone per year amount to upwards of $7,000. The average pay for a pilot in this type of work is $100 a week. Thus, for two pilots, $10,400 a year, exclusive of the salaries of relief pilots that are hired occasionally. A good mechanic makes about $50 a week or $2,600 a year. The hangar and office rent amounts to approximately $1,200 a year. Without figuring in various and sundry expenses which naturally enter the ledger of flying for news, the approximate cost of operations, exclusive of insurance, is thereby about $21,000 per annum.

Full coverage insurance on the planes and a blanket insurance policy for the photographers, pilots and reporters when flying on a newspaper assignment amounts to at least $9,000 a year in premiums paid. In addition to this insurance covering fire, theft, crash, property damage and passenger liability, the *Daily News* carries for its employees who are flying in their news capacity either in the two Wacos, or on an airline—a compensation policy which in this instance exceeds the minimum policy set down in the Newspaper Guild contract. The Guild contract calls for a minimum policy amounting to $10,000. The *Daily News*, however, holds a policy for $25,000. Totaling such approximate figures, we can assume that the *Daily News* pays about $30,000 a year for the privilege of bringing the first and best pictures and stories to its readers. Add to that figure the cost of the planes—about $16,000 apiece—and you have the financial set-up of this aviation picture part of the *Daily News*—$46,000! That amounts to $3,833 a month, $958 a week or $136.90 a day!

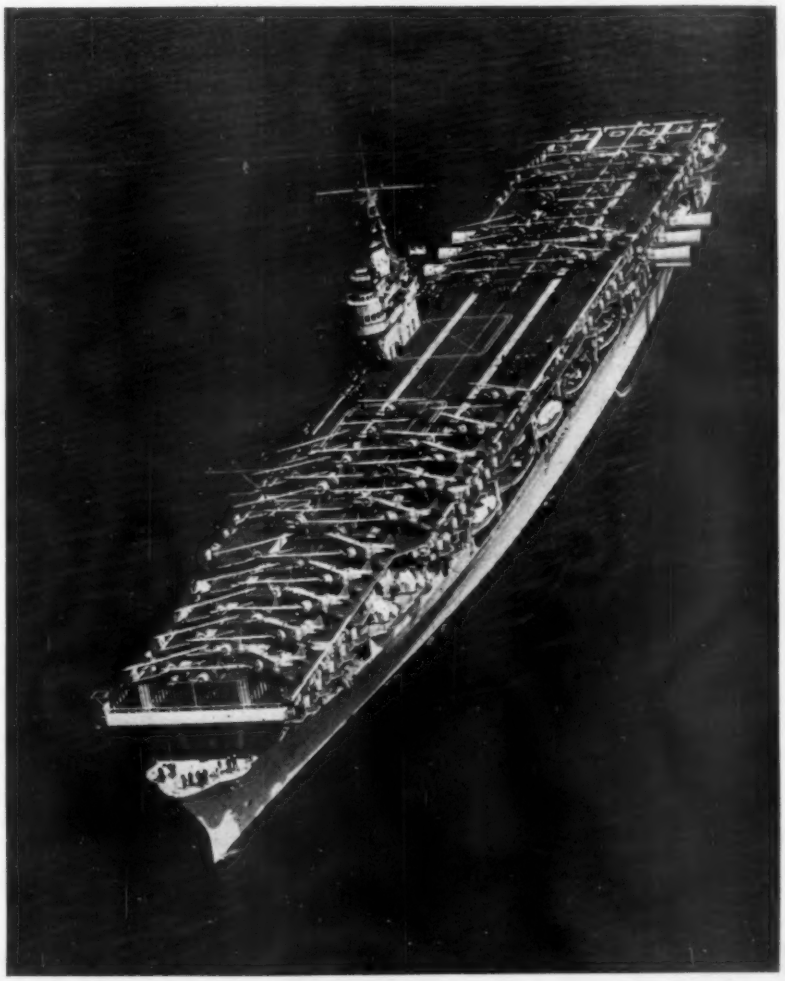
Getting seemingly impossible pictures or taking a reporter to the "big story" is the job of these planes and their pilots. When the telephone rings in that tiny office at Roosevelt Field, it may be just a request for an aerial view of a Sunday traffic tie-up on some highway. Or it may be a polite order from Picture Editor McEvilly to get a shot that calls for hours of flying, a landing at an improvised airport—with or without cows—hours of waiting around while the photographer and reporter get their story, then the trip back home and another wait for some other assignment. *Daily News* pilots are on 24 hour call and whatever the assignment is over land or sea, the pilot enables the reporter or photographer to get the story for the next edition.

Over-water flying was Duke Krantz' allotment when the *Morro Castle* burned at sea. Eight miles off the coast of New Jersey and just a few hours from port the luxury liner, returning from a holiday cruise, suddenly caught fire. Word of the disaster shattered the airwaves and, within a few minutes, a small white ship took off from its home airport and climbed through

(*Continued on page* 60)



Another Daily News worldwide scoop was this photograph of the Vultee flown across the Atlantic by Dick Merrill and Harry Richman. Krantz found the ship after it had crashed in Newfoundland, got this photo back even before the rescue planes arrived.



When things aren't rushing, the Daily News planes may be assigned to get shots of ships entering or leaving New York harbor. This is the aircraft carrier U.S.S. Ranger.

WHAT'S UP THERE?

Above these clouds is clear air, ideal for flight operations. Below may be stormy, unflyable weather.

"Tommy" Tomlinson today is chief engineer for Transcontinental & Western Air, Inc., known more popularly as TWA. He has been with that airline since its founding and, prior to that time, was employed by predecessor airlines that subsequently went to make up the present TWA. Tomlinson is a former Naval airman and was of the Navy's famed "Three Sea Hawks," a crack stunt team. He resigned from the Navy in 1929 (he is a lieutenant-commander in Naval Reserve aviation today) to go into commercial aviation. It was he who flew the first Douglas DC-2 coast-to-coast in the record time of 11 hours 5 minutes, thereby establishing 18 new world and American transport records. Since that time he has done a great deal of "over-weather" high-altitude research flying for TWA in a Northrop *Gamma*. Here, for the first time, his findings are published in full.

FROM the beginning of air transportation in the United States there has been a constant trend toward higher flight levels. Especially, since the development of instrument flying involving extended operations through and above storm areas, demand has risen for transport airplane performance which would permit rapid climb through cloud layers and cruising operations on top of overcast conditions.

Air transport operations on top of and through storm conditions doubled with the coming of the modern transport. The experience thus acquired pointed to the advisability of operating at higher levels than were possible even with the latest equipment.

When these transports first were placed in service, cruising levels of 14,000 feet were fairly common. Shortly, however, experience disclosed that this altitude was above the point at which flying personnel could retain normal efficiency without the aid of oxygen. The effect on passengers was adverse though not dangerous. As a result present day operations are limited to 12,000 feet altitude, except in an emergency. Only over mountainous regions are transports flown regularly at 12,000 feet or higher; the average cruising level of all flights is about 8,000 feet.

However, 1939 may see the level of air transport cruising raised to between 16,000 and 20,000 feet, as the result of experience gained in test flights up to and above 34,000 feet. The pressure cabin and cockpit will be equipped to maintain 8,000 foot pressure at the lower level and 12,000 foot pressure at 20,000 feet, which upper level will be used in emergency.

Operation at this level is economically sound. The engines are equipped with two-speed impellers to accomplish supercharging. The fuselage weight has not been increased; the normal structure is merely sealed. These factors do not greatly increase the first cost of the airplane whereas the cost of building an airplane to operate at 30,000 or above could easily be increased by 50 per cent over that of the airplane to operate at 20,000 feet.

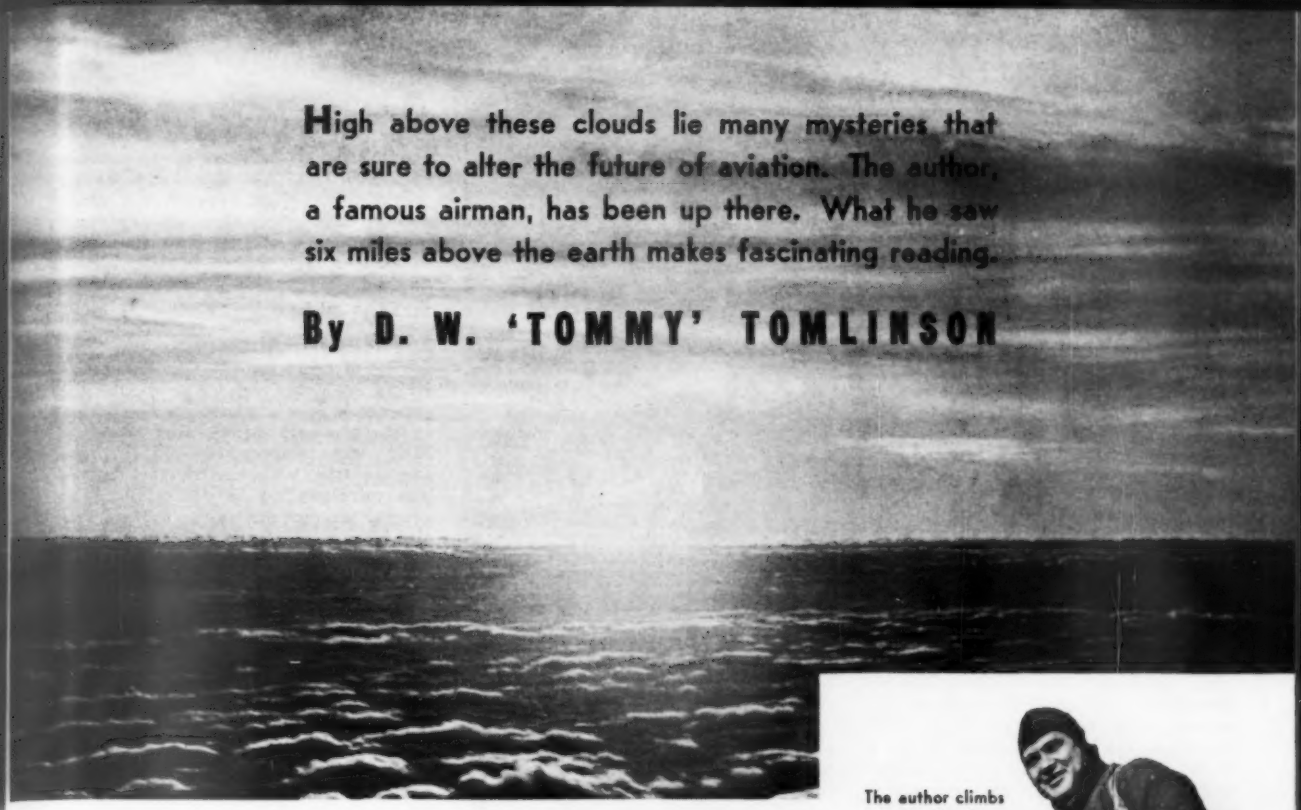
Above 20,000 feet, and particularly above 25,000 feet, costs begin to mount rapidly, due to the necessity for elaborate engine and cabin supercharging plants, airplane structure, special propellers and complication of other items which are not critical at lower levels.

Therefore, due to the fact that high altitude operation involves long flights and at extreme heights of 30,000 feet or above, flights of less than 2,000 miles are inefficient. With our present knowledge 20,000 feet appears to be the top economical limit. In fact it looks as though revolutionary improvements in power plants and propulsive methods will have to come before the dream of passenger transports flying through the stratosphere can come true.

Our first cross-country flights, made

High above these clouds lie many mysteries that are sure to alter the future of aviation. The author, a famous airman, has been up there. What he saw six miles above the earth makes fascinating reading.

By D. W. 'TOMMY' TOMLINSON



It is known that 90 to 95 per cent of bad weather is cleared above 20,000 feet.

The author climbs into the Northrop to make a flight he describes here.

with a Northrop *Gamma* equipped to fly up to 27,000 feet, were to investigate operating conditions between 20,000 and 25,000 feet. On the first flight of approximately five hundred miles, the plane was cruised at 22,000 feet. During the first 300 miles, conditions were clear and unlimited. Upon approaching the destination, an overcast having a top of 20,000 feet was encountered. Radio advice from ground stations reported local thunderstorms of moderate intensity in the vicinity of the destination. When about 100 miles distant from the destination and when flying 1,000 feet above the overcast, distinct domes above the local thunderstorms were plainly noticeable. These domes appeared to rise only 2,000 to 3,000 feet above the general overcast. No towering cumulus clouds of the typical thunderstorm variety were in evidence. The temperature while cruising above the overcast held consistently at —50° F. Upon descent into the clouds, a temperature of 30° F. was encountered at 18,000 feet, and heavy clear ice began to form rapidly. Control of the airplane was not affected. This icing condition lasted through an altitude range of approximately 2,000 feet. Below this strata the temperature rose above freezing and the ice rapidly disappeared. Moderate turbulence was encountered during the descent.

Thunderstorms, accompanying a cold front, were investigated. One typically severe thunderstorm of this type was investigated at an altitude of 26,000 feet. As observed from the airplane the anvil cloud, typical of this type of storm, had its origin at an altitude of approximately 24,000 feet. Between the 20,000 foot level and the base of this cloud there was severe turbulence as evidenced by dark clouds, almost purple in color, moving with great rapidity in relation to one another. This turbulence was so obviously severe that no attempt was made to fly in the near vicinity of this portion of the storm. Flying at 26,000 feet, the plane was brought close to the anvil head, without any indication of turbulence. The storm was moving in a southeasterly direction. The storm was approached from the southeast and the plane flown around to the northwest side of the anvil cloud, to determine its approximate diameter which was about 10 miles. After reaching a point to the northwest of the storm center, the plane was flown on a southeasterly heading through the thunderhead, the top of which can only be estimated as reaching to an altitude of about 35,000 feet. The temperature outside of the cloud was —6° F. Upon entering the cloud, a slight bump was felt and while traversing the cloud the rate of climb indicator

This type of "overweather" flying is familiar to all air passengers. The author flew through solid cloud formations like this that were more than 3½ miles deep!

showed a constant ascent of 300 feet per minute. The temperature within the cloud was —4° F. The cloud appeared to be composed of fine snow particles with some moisture which formed light ice on the plane. This ice formed on the windshield in peculiarly shaped rings as the drops of moisture struck. Upon leaving the cloud on the front side of the storm, another slight bump was felt and the rate of climb indicator returned to level flight indication. This experience indicated that the anvil clouds accompanying thunder storms may be safely flown through at sufficient altitude above their bases to clear the turblence in which the cloud has its origin. No lightning was visible viewing the storm from 26,000 feet although heavy lightning was seen in the lower portion of the storm below 15,000 feet.

A non-stop flight of 1,100 miles (Kansas City to New York), cruising at altitudes between 20,000 and 27,000 feet, was made at the time a severe hurricane of tropical origin was progressing northeastwardly up the Atlantic coast. The route flown lay approximately 75 miles to the north of the center of this storm and directly across its path. As seen from a distance of two hundred miles, the top of this storm had the appearance of a huge umbrella; the height of the storm at the top of the umbrella-shaped cloud is estimated to have been in the neighborhood of 35,000 feet, thus reaching to the base of the stratosphere. This cloud extended to the north and west of the storm to a distance estimated at 150 miles. At its outer fringe it was a thin cirrus sheet lying at an estimated altitude of 30,000 feet. This continuous cloud thickened as it approached the center of the storm until it joined with lower cloud layers at approximately 25,000 thousand feet. These lower layers spread out to a distance of about one hundred miles from the storm center, becoming broken, with several intermediate layers below 10 000 feet, at a distance of 75 miles from the center. During the descent and approach of the airplane to its destination, the plane passed through these intermediate cloud layers in which moderate rain and moderate turbulence were encountered. The appearance of the storm center from an altitude of 25,000 feet was black, with purple hues above and below the junction of the upper and lower cloud layers.

The flights made with this airplane proved that satisfactory cruising operation could be expected of engines equipped with two-speed impellers, up to critical cruising power altitude. Engine operating conditions were satisfactory throughout the range of airplane performance, except that in high impeller gear the specific fuel consumption was high, .55 lbs. per h.p. hr. It was concluded as a result of these tests that air transport operations involving continuous cruising up to 20,000 feet altitude could be safely carried out, with power plants equipped with the two-speed impellers.

Observed weather conditions supported the conclusion that 90 to 95 per cent of "bad weather" is cleared when flying at 20,000 feet. Any severe conditions involving turbulence above this level may be avoided by flying around the storm center. Such detours should rarely necessitate departing more than 50 miles from the center of an airway.

Two round trip flights were made from Kansas City, to Dayton, and one non-stop flight from Kansas City to Princeton, N. J. The latter flight and one east-bound flight from Kansas City to Dayton are significant.

The *Gamma* departed from Kansas City with J. C. Hiestand of TWA, and Captain H. G. Armstrong, U. S. Army Medical Corps, as observers. A cruising power climb was made on a course for Columbia, Mo. Four distinct layers of clouds were traversed. The first layer, broken in places, extended from 2,000 to 5,000 feet. The second layer, likewise broken, was between 8,000 and 10,000 feet. The third layer, more nearly solid than the first two, was from 19,000 to 19,500 feet. The uppermost layer was a thin sheet of haze-like cirrus and lay at 28,000 feet. On this flight, as on previous ones, the moment the plane touched high cirrus clouds, heavy static was heard in the radio. This static was so loud—a high-pitched buzzing note—that radio beams were obliterated. About 10 miles west of Columbia, the plane was stabilized at cruising power, 500 h.p., at 30,000 feet on top of the cloud formation which extended to the east as far as could be seen. The top of the upper level rose gradually to 30,000 feet, so the cruising altitude was raised to 31,000 feet, temperature —35° F. The average true air speed of the *Gamma* was calculated to be 225 m.p.h. The general weather across the 560 miles of airway was low overcast, 500 to 1,000 foot ceiling with moderate snow.

Timed checks over the radio range station at Columbia, Mo., showed the ground speed during climb to be 190 m.p.h. From this and the magnetic heading, the average wind was estimated at 50 m.p.h. from the west. Next check, over St. Louis, Mo., gave a ground speed of 292 m.p.h. wind estimated at 67 m.p.h. from the west-northwest. The plane was now flying at 32,000 feet on top of a solid overcast about 1,000 feet below. The next 230 miles to Indianapolis, Ind., were covered in 37 minutes. Careful cross checks of the beam legs were made over Terre Haute, 166 miles east of St. Louis, and over Indianapolis. There was no question about the accuracy of the time interval. The average ground speed was 373 m.p.h. The average wind was calculated from drift angle and true air speed to have been 148 m.p.h from the west.

Toward the end of the flight, the problem became one of locating Dayton, which had last reported a 1,000 foot ceiling. The unusual speed made it easily possible to overshoot the field. Descent was begun immediately after passing Indianapolis, entering the cloud at 30,000 feet. Viewed from above, this cloud looked like any other cloud. However, upon entering it the appearance of the cloud was like a moderate mist instead of the dense fog-like aspect of the normal cloud. Also the instant the plane touched the cloud, all radio reception was ended because of heavy static. Without the radio beam, which had been plainly audible above the cloud, all that could be done was to maintain an easterly heading. All previous experience the writer had had with high clouds was that they usually consisted of several layers 1,000 feet or so in thickness. After descending to 18,000 feet, during which period the cloud formation was solid and unchanging, both in appearance and static effect, real concern was felt about over-shooting Dayton. The plane was therefore put into a spiral. The bottom of the cloud formation was reached at 8,000 feet—22,000 feet of absolutely continuous cloud!

This flight proved the existence of high velocity winds at the base of the stratosphere above storm conditions in

(*Continued on page 72*)

I Learned About Flying From That! — No. 4

Here is a famous airman who once went for a plane ride he should have been more cautious in accepting. But he learned a lesson from which he has profited ever since.

By BEN O. HOWARD

THERE'S always somebody building an airplane. Maybe the man is a manufacturer of aircraft and he's getting out a new and better model. Or maybe the kid down the street has bought an old job which he's rebuilding from prop to tail surfaces, sure that he knows a lot more about aerodynamics than the original manufacturer and out to prove it. When he gets the job all done, he goes to the boy next door.

"I'm going to hop the job tomorrow morning," he says. "You'd better come along. What do you say?"

So the teen-aged genius and the neighbor boy go out to the field—it's usually Sunday—and go for a little test hop. Sometimes the ship flies all right. But, too often, it doesn't. It sheds a wing, drops its motor, flutters apart, and in the Monday morning papers you read how the neighbor boy has become a martyr to his own faith.

Now, whether or not the plane builder is bringing out a new model or the boy next door has created something of his own in the barn, the situation is exactly the same. I've known a lot of nice, bright young fellows who have written themselves off in a home-made job. And, as I write this, 10 splendid men—all needed vitally in this expanding industry of ours—have died in a test of one of the biggest ships ever built.

I got my lesson in neither a home created job nor a Leviathan. I picked the new and untested airplane of moderate size built by a noted manufacturer. I went, like the neighbor boy, on my own volition and responsibility.

The year was 1930.

The field was rolling, green Lambert, at St. Louis. The airplane was the new Ryan *Brougham* of that year. The pilot, one of the finest I've ever known, was Red Harrington, testing for the Ryan company at that time, now retired from aviation.

"The job flies swell," Red told me. "How about a little hop?"

"Sure," I said. Remember that this was nine years ago, and that I was considerably more of a young sprout than I am now. In those days I seldom let a little calm thinking interfere with my fun. I don't recall that I bothered to ask him how much he had flown the ship or what he had put her through. All I knew was that I was looking at a beautiful new airplane.

I wasn't the only absent-minded one. There was a newspaperman at the field. He said he'd like to go along, too. So Red started the ship and let her warm up. I went over the job. The Wright J-5, 220 h.p., had been replaced by the J-6-9, giving 300 h.p. The lines had been

(*Continued on page 76*)

This is the author at the controls of what was the largest X job known—the DC-4.

Each student is a little problem all in himself. Good instructors know that.

World's greatest student "laboratory" probably is the Army's Randolph Field.

THERE ARE ALL KINDS OF STUDENTS

By TEX RANKIN

Any man who has taught 3,000 people to fly surely has stored up a wealth of knowledge about students. The author presents some interesting facts on fledglings.

IT HAS been my practice never to take the stick from a student unless absolutely necessary to avoid trouble and I have found that this situation has arisen infrequently. Taking the controls away leads to a loss of self-confidence. In spins I made it a practice to explain all I could on the ground, give a thorough demonstration in the air and then give the student the controls. I have let students spin down as many as 10 revolutions before I would ask them to let me take over the controls. That is why I usually begin spins with students at 5,000 feet. If they don't recover immediately I give them verbal directions. Seldom have I had to repeat these directions. Always, I have tried to talk calmly to the student when in a difficult situation. If the instructor raises his voice unnecessarily the student is almost sure to become panic-stricken. That's what really caused the trouble I am about to relate.

The student, a young man, went up for spins with me after about 10 hours of dual instruction. He was very anxious to solo. I had a rule to teach spins as a part of all solo courses. I always made sure that my students could, of their own free will, get into and out of a spin before I would permit a solo flight.

On the day I picked for his initiation there was a heavy overcast at 2,500 feet. Instead of going up, as I should have, I decided 2,500 would be enough. My student had proved alert and quick-witted and the combination of my faith in his ability and the necessity of keeping below the overcast was the beginning of my undoing.

I was, as always, using a ship which had no bad spinning characteristics. And, as was my custom, I demonstrated the manner in which one gets into spins and out of them. I spun down several times, climbing back after each recovery to the 2,500 foot level. Then I signalled for him to take over the controls.

He eased back on the stick and throttled the motor at the same time. He kicked the ship into a spin as it reached the stalling point. It started winding down. I allowed him two turns and then told him through the speaking tube to get out of it. There was no response to my mildly-phrased request.

At four turns I raised by voice as I insisted that he push the stick forward and center the rudder. Still nothing happened. My next order was that he was to give me the controls. I told him to follow me through as I came out. Still he wouldn't let go. By this time we were getting close to the ground. I pulled the controls away from him without difficulty, leveling off at about 500 feet and coming in for a landing.

I sent the student home after having explained to him that it was my own fault that he became nervous, because I had raised my voice in giving him directions. A few days later we went up again and he learned to spin. A short time later I soloed him. In later years he became an excellent pilot.

The first point in connection with this experience is something that you may not choose to believe. During the past 20 years I have personally instructed or have closely supervised the instruction of 3,000 students, both men and women, ranging in age from 16 to 65. and this is the only time I have had any student "freeze" on the controls.

Big air schools like Parks Air College are doing much to break down old beliefs about a pupil's reactions.

I have discovered, in these years, that there are all kinds of students, that a "freeze" of any kind is very rare, that it is usually due to a mistake on the part of an instructor and that it can be avoided with proper care.

Second, this particular student had "ground fear," and needed height to overcome his complex until he mastered spins.

I had another student once, a Swedish fellow who gave me a laugh and almost a ducking. He came to me right after the war, when I hadn't acquired a speaking tube for instruction purposes but was employing hand signals. This chap was very large and very powerful—a cross between Tarzan and a Viking.

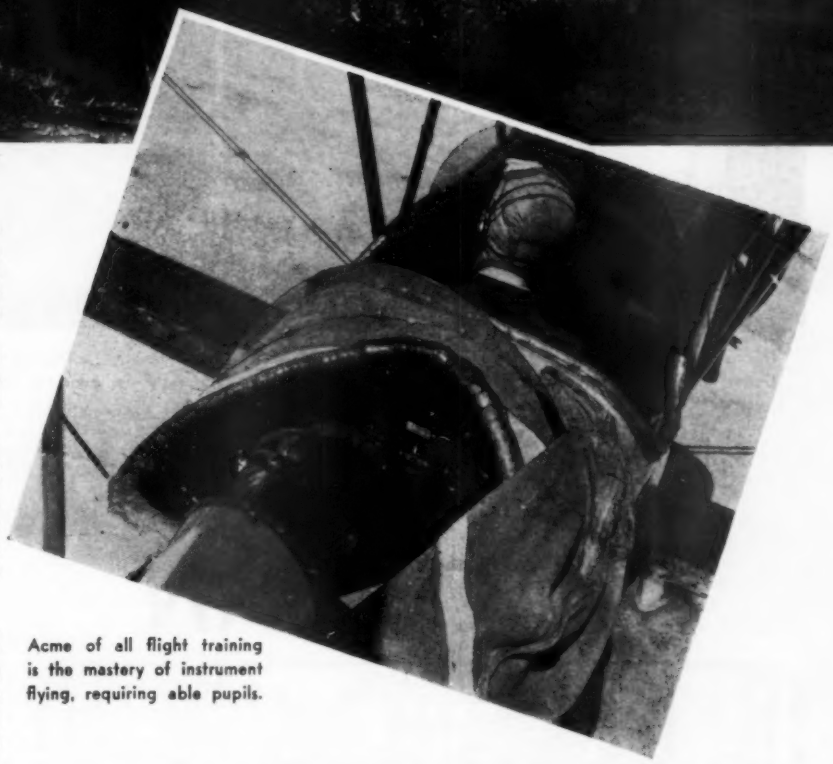
He sidled up to me.

"Ay vant to fly," he said. "But ay don't think ay bane strong enough."

I took one look at him and assured him that he was. In the face of further doubts on his part I told him that I'd give him a demonstration to prove to him that it was so easy even a child could fly airplanes. After explaining the signals to him I got him into the rear cockpit and I climbed into the front. The chugging of the OX-5 drowned out his protests that he was sure he wasn't strong enough to handle the controls. My last words to him were to watch the stick. When I shook it violently he was to take it and fly the ship level until I signalled for a turn.

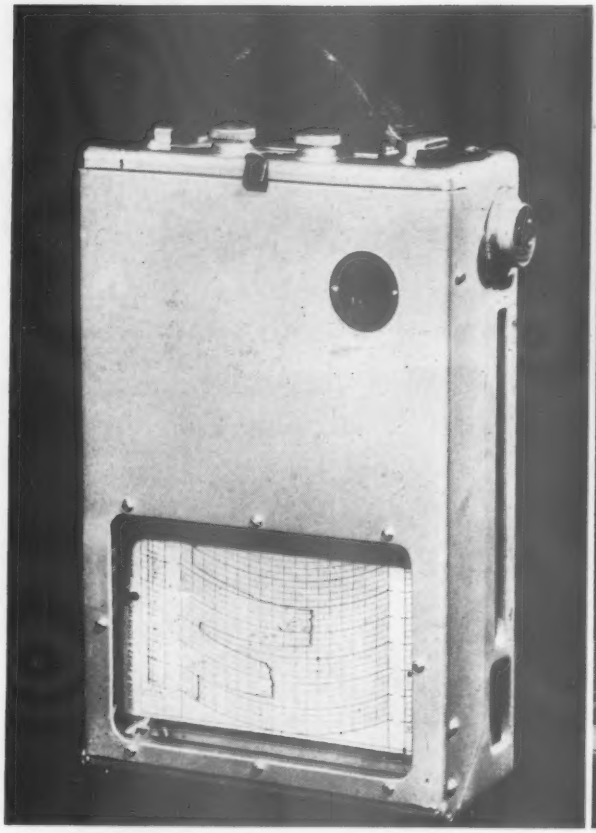
At this time I was using a narrow strip running north and south along the Willamette river at Portland, Oregon, for a field. There was a bluff to the east. To the west was a river. At the time we took off there was a brisk east wind blowing, sending billows of turbu-

(*Continued on page 66*)

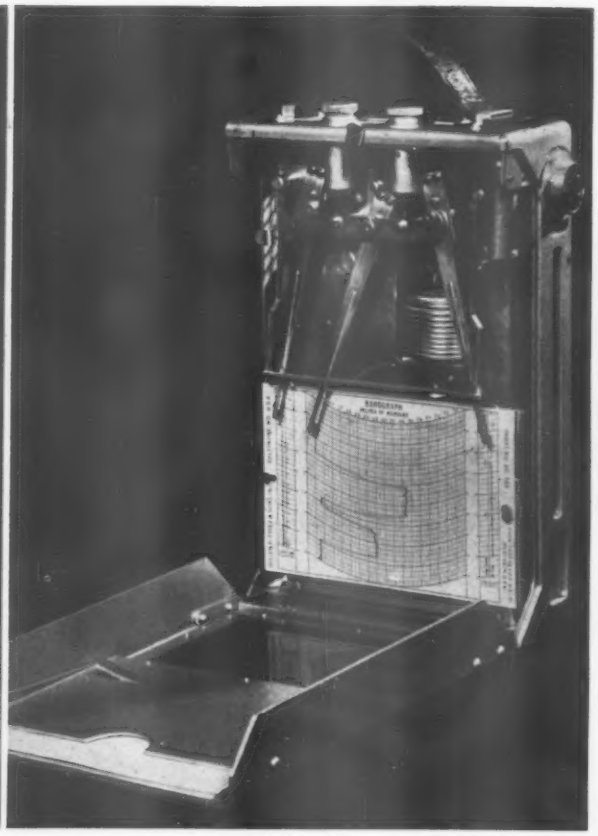


Acme of all flight training is the mastery of instrument flying, requiring able pupils.

Less than one per cent of all persons who have come to the author for flight training have had to abandon flying because of actual physical or mental disabilities.



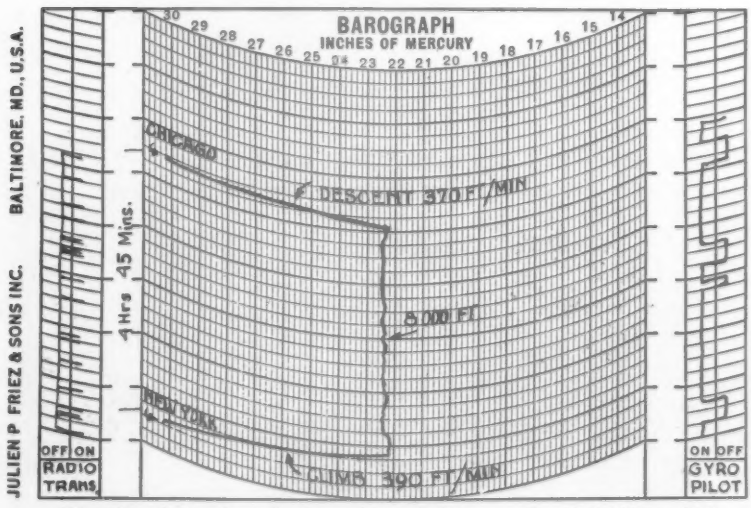
This is the barograph, ready for installation in the tail of a United Airliner. It measures 8¼x5½x2" and weighs three pounds.



Here the barograph's three pens are visible. From left to right are pens for radio, plane's flight course and gyro pilot.

TIN WATCHMAN

by KURT RAND



This enlarged chart facsimile shows what took place on a New York-Chicago flight.

MY friend, a veteran airline pilot, said: "This business is gettin' tougher all the time. They don't take your word for anything any more. When they ask you 'Where were you at 10:30 p. m. the night of June 3rd?' they expect you to give an exact answer. You don't just say: 'Between Cleveland and Chicago flying one of the regular trips.

"Oh no. Nothing as vague as that. They insist upon an answer like this: 'At 10,000 feet sea level, over Vickery, O., air speed 177 m.p.h. indicated, temperature 21 degrees, giro pilot in control, had just finished a radio contact with Cleveland company ground station.'

"Worst of it is that they can tell if you make a mistake in your story. And if you do they jump down your throat. If you've been reporting all along on a trip that you were in clear air at 10,000 feet and actually you've been scooting along below the overcast at 3,000, you're sunk.

"Because they've got those damned mechanical spies—some of the boys call 'em lie detectors—back in the tail. The gadget just about tells everything you've done to the airplane. Next thing you know they'll have a dictaphone in the cockpit to get the conversation between the pilots. They won't even let you damn Airways Traffic Control then."

If you know the breed you know that

Pilots were suspicious at first. Now, however, they welcome the added flight check supplied by the flight analyzer. This is the story of still another step toward complete air safety.

The analyzer is installed in this tail compartment and checked before a flight.

most of the airline captains like to grouse a little; some of them make a career of it. And the story as outlined is the pattern that is followed by most of the objectors to the little instrument they call the mechanical detective, when they don't use harsher words.

The "lie detector" is a device patented by the Friez Instrument Company of Baltimore, Md. It consists of a barograph and two electrical connections that operate three recording pens. The whole instrument is packed inside an aluminum case that is 2 in. thick, 5½ in. wide and 8¼ in. long. It weighs three pounds.

The recording is accomplished by movement of a record card by a clock that is part of the analyzer. Movement of the card causes each of the three pens to leave thereon a track. The pen from the barograph records on one section of the card that is ruled off in intervals of inches of mercury.

This pen in effect draws a vertical picture of any flight on which the instrument is carried. The pen begins its record at the moment the instrument is put into an airplane. It shows the taxiing of the ship to the take-off line, the rate of ascent to cruising altitude, any changes of altitude during flight and the descent.

Inasmuch as this portion of the card also is ruled off into 15 minute time intervals, it is readily possible to read directly the height—in inches of mercury—of the plane at any given moment of a trip. Reference to a scale makes it possible to determine directly in feet the height at any mercury pressure reading.

The time intervals also make it possible to determine exactly what rate of climb was adopted by the pilots. Suppose it took 16 minutes to climb to the chosen cruising level of 8,000 feet. Divide the 8,000 by 16 and discover that the pilots climbed at the rate of 500 feet per minute. Rate of descent is calculated the same way.

One of the other two pens is connected to the main switches of the automatic pilot. This pen shows an "off" and an "on" indication. It is thus easily possible to tell the exact length of time the automatic pilot was being used during any trip.

There was a time when airline pilots were using their automatic pilots to fly 80 per cent of the time in the air. This has changed. Most of the pilots are flying the ships at least 50 per cent of the time manually. The giro pilots are used in rough air and often in climbs and descents.

That third and last pen is connected to the transmitter microphones. Each time the pilot or first officer talks to the ground or to another company ship in the air the pen notes the fact on a special time strip of its own. Thus, when a pilot says he talked to Cleveland at 10:21 p. m. he has the record on his flight analyzer card to prove or disprove his point.

The clock and the card—3x5 in.—have a duration period of eight hours. This is considerably longer than the longest consecutive scheduled flight now made by any of the airlines and it provides an ample margin for emergencies.

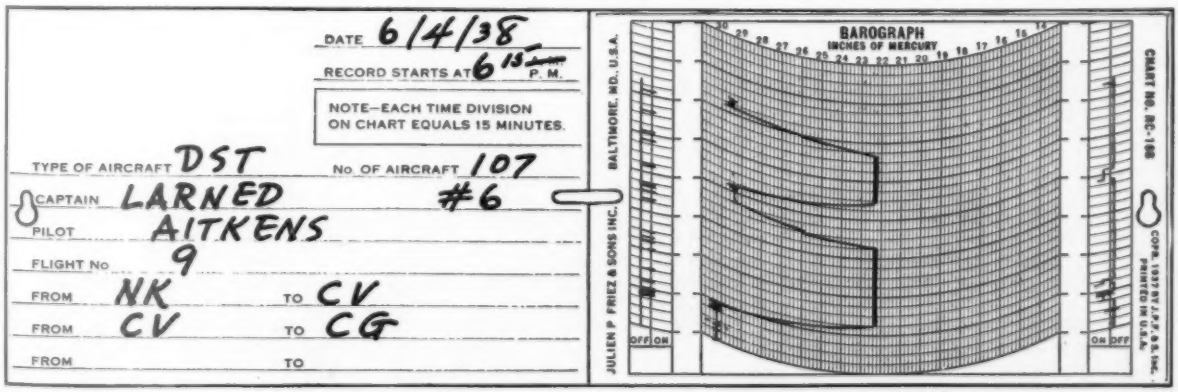
Development of this recorder, like so many other flying gadgets, can be traced back to the ideas of Maj. R. W. ("Shorty") Schroeder, vice president in charge of safety for United Air Lines. The major has been advocating some sort of automatic recording device for airliners for years. Finally R. D. Kelly, chief instrument engineer for United, and engineers from the Friez company got together.

The instrument as now developed was the fruit of their labors. United bought 75 of the recorders and installed them on every one of their Douglas DC-3s and Boeing 247Ds. The gadgets were put into service in 1937, beginning in the summer. For a while the pilots were extremely suspicious about the whole affair.

Little had been said among the operations officials about the purposes of the gadget and their reasons for buying them and the pilots were angered by the secrecy and the implied insult to their abilities and honesty.

At crew transfer points the departing crew members would stop for a moment with the men who were carrying on. There would be the usual exchange of dope on the weather, handling characteristics of the plane, etc. Then one of the departing team would whisper to the new skipper: "Watch your step. One of them damned mechanical stool pigeons aboard."

That has passed now, because there's one on every United plane that flies. Part of the duties of the maintenance



This is a front and rear view of a chart from a typical flight. Center line at right shows Cleveland stop.

The flight analyzer is installed inside the baggage compartment door indicated by the arrow. United Air Lines already is working on a new, more complete barograph.

crews are to see that the analyzers are aboard, properly connected and operating. The chief dispatcher is held responsible for this matter. He must see that a fresh flight chart is placed in the special rack of the mechanism. He must be sure the pens are properly adjusted, the cover of the gadget closed and the device placed in position behind the express compartment at the tail.

Although this is not generally discussed, the company decided to place the analyzer at the tail because the tail of any airplane is so often intact following accidents. It was hoped that in case of a crash—and the airline operators believe that some of these might be expected despite their efforts to foresee and prepare for every emergency—the analyzer chart would show something of the causes.

At the conclusion of every trip service mechanics immediately remove the flight analyzer and deliver the chart to the chief dispatcher. This man examines the chart and discusses it with the pilot before the latter leaves the field at the end of the run—while all that happened still is fresh in the memory of the airman. After this discussion the charts are sent to the division superintendent, the chief pilot and the chief engineer. Then each chart is placed on file.

"It was pretty funny when the analyzers first went on the ships," laughs Walt Addems, United's eastern division flight superintendent at Chicago airport. "When there was something a little unusual about any flight the first thing you would see would be the pilot coming into the flight dispatcher's office with the analyzer in his hand.

"The boys weren't going to wait for the service crews. They went out and got the gadget themselves and brought it in to talk it over with the rest of us—and they'd always have some excellent explanations of why the analyzer showed they were flying at 4,000 while they'd been reporting they were at 8,000."

As a matter of fact several of United's veteran pilots lost their jobs over flights made contrary to company regulations—flights that were shown on the analyzer but were not reported as truly made by the airmen. A shakeup in company personnel in the spring of 1937 could be traced directly to the little instrument cards.

Since that time, so far as the company is concerned, the analyzers have been used chiefly to stimulate precision flying. The flight record cards provide ground officials and pilots with an accurate picture—so far as it goes—of their actions in a flight. The card makes possible analysis of the flight, so that the pilot recaptures in graph form his course and can see what he did or should have done to make the flight as directly and efficiently as possible.

Studies of accumulated cards has been revealing. The engineer's office after studying thousands of them have discovered that regular flights usually are made at a smooth, straight level, whether flown manually or on automatic pilot. Occasionally a chart will show that a ship climbed to one operating height and then descended several thousand feet or climbed on higher. Reference to the records of the flight usually show that the chosen height proved to be bumpier than the pilot expected, and that he obtained permission from flight control agencies to change his cruising altitude.

The crash records of the flight analyzers have not been as successful as expectations led the company to believe. United has had three accidents since in-

(*Continued on page* 82)

Airline Records

AMERICAN operated scheduled air carriers in 1938 set all-time records for the number of miles flown and passengers and express carried, according to final reports received by the Civil Aeronautics Authority from operators of the domestic, territorial and foreign services and made public today.

The total number of revenue miles flown on all air services from 1938 was 81,058,127, an increase of 5 percent over the 1937 figure of 77,403,365. Passengers increased 21 percent, from 1,267,580 to 1,536,111 and air express pounds 5.22 percent from 8,984,049 to 9,452,600.

Revenue passengers on the domestic airlines increased 22.78 percent in 1938, when 1,176,858 passengers were carried as against 958,510 revenue passengers in 1937, and the revenue passenger miles flown in 1938 totaled 476,402,280, a 16.97 percent increase over the 1937 figure of 407,295,893.

There were 345 airplanes in operation on the scheduled airlines at the end of the year, and these aircraft consumed 45,310,192 gallons of gasoline and 829,870 gallons of oil during 1938. The air carriers furnished employment for 13,309 persons as of December 31, classified as follows: pilots, 820; co-pilots, 605; stewardesses, 310; stewards, 141; dispatchers, 187; mechanics and riggers, 3,415; other hangar and field employees, 2,635; office employees, 4,724; and all other employees, 472. The 1937 personnel total was 11,546 which included 749 pilots, 589 co-pilots, 294 stewardesses, 126 stewards, 3,258 mechanics and ground crew men, 2,349 other hangar and field personnel and 4,172 operations and office personnel.

On the domestic lines alone 110,840 flights were scheduled, 104,964 were started, and 103,939 or 95.36 percent completed. In 1937 these figures were 107,418 scheduled; 100,595 started and 98,807 or 95.4 percent completed. In 1937, 2,966 extra sections were flown; in 1938, the extra sections totaled 4,036.

The average speed for all the domestic carriers during the year was 153 m.p.h., and the average length of a passenger's trip was 415 miles. The revenue-passenger load factor was 50.18 percent.

What Names!

IF names mean anything, United Air Lines has three pilots who, together, seem to have all the requisites for their profession. "Pickup", "Going" and "Quick" should indeed make an appropriate combination on anybody's airways.

First Officer Quentin Quick flies over the Seattle-San Francisco section of the Pacific Coast route. Captain C. V. Pickup serves on the other end of the airway, between San Francisco and Los Angeles. Captain James Going is a pilot on the Portland-Salt Lake division.

ONCE AN AMERICAN

Originally built in this country by Burnelli, this design was sold to a British firm which just completed the above prototype.

AIR CORPS B

by

JOSEPH S. EDGERTON

Compare these sleek P-35 fighters to the Army's first "warplane" at the bottom of this page.

30 YEARS ago a flimsy, shuddering kite chugged its way into the air, thereby marking the first flight of an Army airplane. The day was August 2, 1909, the airplane a 45 h.p. Wright. What a contrast today!

IN the midst of launching the greatest military aviation expansion program in the peacetime history of the nation, the Army Air Corps will pause briefly on August 2 to commemorate the birth of military aviation.

On August 2, 1909, a War Department board convened in Washington after witnessing flight tests which had reached their spectacular climax four days earlier in a 14-minute round trip flight from Fort Myer to Shuters Hill, near Alexandria, Va., and formally accepted delivery of the first military airplane.

The airplane so acquired by the Army had more than passed all of its tests. It had made the final cross-country flight at an average speed of 42.583 m.p.h., mak-

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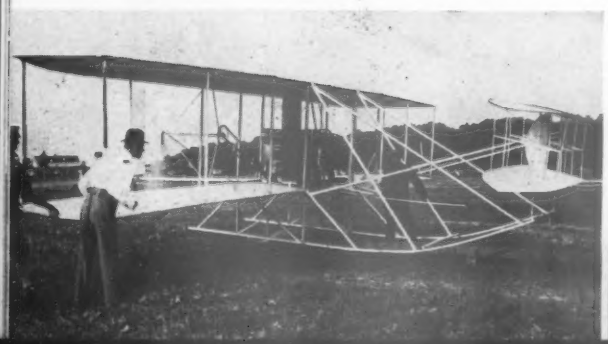
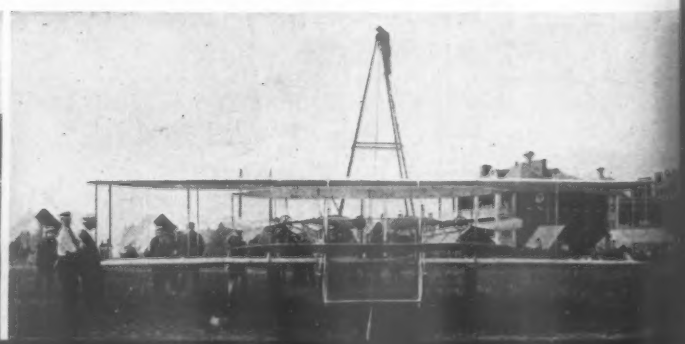
This first Army airplane flew a maximum of 47.431 m.p.h. for 14 minutes at an altitude of 450 feet.





To those few men who worked with the first airplane, this mighty bomber must be a startling contrast.

ing the return flight to Fort Myer at the sensational speed of 47.431 m.p.h.! It had attained a maximum altitude of 450 feet during the flight. Orville Wright, at the controls, had not only made this record-breaking cross-country flight successfully; he had carried a passenger. This passenger, young Lieutenant Benjamin D. Foulois (later to become chief of the Army Air Corps) was making his first flight. Upon its completion, he was warmly congratulated by fellow officers on his "safe return."

The cross-country flight clinched the sale of the first military airplane to the Government. Moreover, it earned for the Wright brothers a bonus of $5,000 for excess speed above contract requirements. The airplane was a Wright Model B, powered with a 45 h.p. Wright engine driving two propellers through sprocket wheels and chains. It was catapulted from a monorail track by the dropping of a weight in a tower and landed on wooden skids which frequently broke and were snatched up by avid souvenir hunters to be made into pens and other gadgets.

That airplane today hangs in the Smithsonian Institution in Washington, the honored forbear of a modern line of combat airplanes which resemble it only as the modern 35,000-ton battleship resembles Old Ironsides.

For that airplane the United States Treasury paid to the Wright brothers $30,000, including the speed bonus. This payment included the training of two Army pilots—Lieutenant Foulois and Lieutenant Frank P. Lahm. General Foulois now is retired. Colonel Lahm today is on duty as Air Officer, 2nd Corps Area, Governor's Island, New York.

Thirty years! Not a long time, surely. Not half the life span of millions of people. Yet it has brought to the development of the airplane changes so astounding, so important to men and nations that their effects scarcely can be measured. Because of the mere existence of fighting planes descended from that puny fledgling in the brief span of three decades, nations have passed out of existence and events are brewing, the outcome of

Fleets of high-performance bombers like these Douglas B-18's will help celebrate on August 2.

These old Keystones were the latest, most formidable bombers in the world not long ago. Even they offer a striking contrast to the present-day Douglas B-18's on the opposite page. Notice the "open air" machine gun emplacements on the Keystones as compared to the enclosed, well-streamlined positions on the Army's latest bombers.

One of the many developments of the Army Air Corps is that of the attack plane. Among the first designs in that category was the Curtiss A-3 of 1920-30 vintage (above). Sharply contrasted to it is the Northrop A-17A which first appeared in 1936 and is currently standard. The Army pioneered this type of modern warplane.

which not even the wisest can foresee.

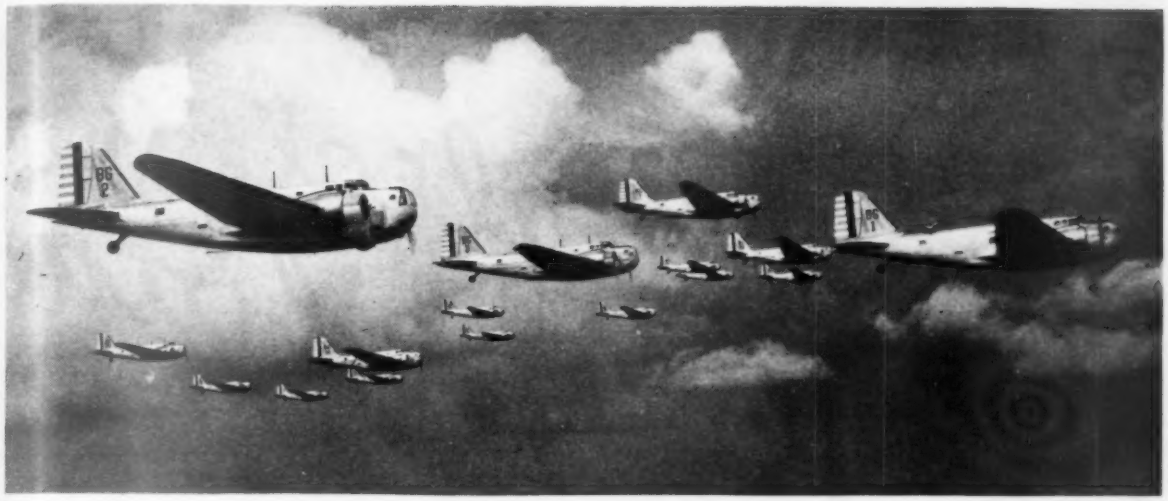
The wildest visionary of 30 years ago scarcely could have given voice to half of the new concepts which aviation already has brought into the consciousness of men and nations. Who can tell what another 30 years of aeronautical development will bring to the world? Chaos among men? The downfall of the weak; the triumph of the strong and unscrupulous? Or, by its sheer threat of unutterable destruction, a new method and habit of dealing among nations—a new era of peace, progress and happiness?

It is well to look back, as the Air Corps is doing in its observance of this anniversary; to look over the path which has been followed and possibly thereby to gain some clue as to the direction in which progress may be made.

There had been some preparation in the Army for the actual beginning which was to be made when the Wright brothers formally turned over to the War Department that first airplane—then a world wonder, today a somewhat curious museum piece. Two years earlier, in 1907, an Aeronautical Division had been established in the office of the Chief Signal Officer. One of the first important achievements of this division was the drafting of specifications and the calling for bids for the first military airplane.

The result was the construction by the Wright brothers of an airplane which they shipped to Fort Myer, Va., for demonstration flights which were witnessed by President Taft and other national leaders as one of the outstanding sensations of the day. These demonstrations ended abruptly, however, with a crash in which Orville Wright was injured and Lieutenant Thomas Selfridge lost his life.

The Wright brothers returned to Dayton and constructed a second airplane, with which they returned to Fort Myer in the summer of 1909 for the series of tests which resulted in the July triumphs and the sale which was consummated on August 2. That date, by the way, made no great impression at the time—it was only by a rather lengthy bit of research that the Air Corps has been able defi-



Today, a mere 30 years from the day it was founded, the Army Air Corps has been granted authorization to award contracts for new equipment that will bring its strength up to 6,000 warplanes (also see page 10). Replacements already have been planned for the first-line B-18 bombers above, with emphasis on four-engined ships.

nitely to decide upon the date for its 30th anniversary celebration!

Immediately the purchase had been made, the War Department began looking about for an airport site. On August 5 it was announced that a 164 acre tract of land had been leased 12 miles northeast of the War Department, at College Park, Md. Orville Wright had looked over the land and pronounced it far better than the parade ground at Fort Myer and superior to another site which the War Department already owned at Omaha, Nebr.

At College Park the War Department set up a temporary hangar, cleared away some trees and brush and created the world's first military airdrome and America's first airport. College Park airport has been in almost continuous use during the past 30 years as a flying field and today is again the home of a flying school and a center for private and non-scheduled commercial flying.

The Wright Model B was shipped from Fort Myer to College Park and there Orville Wright began the flight training of the Army's first pilots, Lieutenants Foulois and Lahm. This training went forward without any specific appropriation of funds; the Signal Corps scraped together what it could from other funds which could legally be diverted. Young Lieutenant Foulois for a long time made a practice of paying for the minor repairs which always were necessary out of his own pocket—quite a burden for a junior officer.

In 1911 Congress specifically appropriated money for aeronautics in the Army for the first time. It was not until 1914, the year the World War broke out in Europe, that an aviation section was created in the Signal Corps and the 1st Aero Squadron was organized in San Diego, Calif., with 16 officers, 77 enlisted men and eight airplanes.

During the interim Lieutenant Lahm, having been drafted for other purposes, Lieutenant Foulois was for a time the whole Army Air Service. After the preliminary training at College Park under the tutelage of Orville Wright, he shipped the one military airplane to Texas

(*Continued on page 62*)

The comparative evolution of the pursuit or fighter airplane is exemplified by the two Curtiss designs above and below. The above is a P-6E of about 10 years ago. Compare it to the latest Curtiss P-40 below which has been ordered in quantity to replace present-day fighters. In 30 years speeds have gone from 42 to 400 m.p.h.

The Neglected Amphibian

The Sikorsky S-43 is one of three current amphibian models, is most expensive.

by FRANKLIN T. KURT

From the private flying standpoint, no airplane could prove so versatile and interesting as the amphibian. Yet that type is almost non-existant.

OF all strange things in this strange business, the strangest is that we do not have more amphibians. If some keen analyst of the past century—say, Benjamin Franklin—should come alive today to see airplanes, we are sure his first question would be to ask what good they are if they cannot take us to and from the places we want to go. Certainly the ability to land anywhere would, to him, rank as their greatest need—and it should also to us. Perhaps the helicopter, when *it* comes, will give us that final answer. But meanwhile the amphibian is by far our best solution. It is a puzzle why it is not more widely accepted.

When Colonel DePinedo, the brilliant long-range Italian flyer of eight years ago, was asked why he always flew a seaplane he answered:

"When I arrive somewhere in landplane and look down, I no know whether field is soft or slope or plant to crops. But when I arrive somewhere in seaplane and look down, I know water is water eve'ywhere." That from a real expert.

How many private flyers would also like to have that positive assurance when they find themselves faced with an off-airport landing? Also how many private flyers would find their peace of mind increased if they flew with the knowledge that they could make a wheels-up landing on their keels on nearly any field with assurance of a very short run and only the smallest of repair bills? The insurance angle alone is clear justification of the amphibian as the logical type of private plane.

The amphibians' many other advantages are almost too well known to need repeating. They permit landings at the very waterfront of most of our American cities. They permit landings in any wilderness, perhaps even where helicopters could not find a place to get down. Even with standard landing gear they cannot be nosed over. Along coastlines and rivers—and nearly a third of our airlines are such—they permit the safe continuance of flying under extremely low ceilings.

Why, then, are there not more amphibians?

We do not think that the flyer and the purchaser are responsible. We are more inclined to put the blame right on the manufacturers who dare not tread from the beaten path and who have not the vision or the close contact with their markets to realize how wide the demand for amphibians truly is. It's like Mark Twain's story of the stolen white elephant where the wearied police finally abandon the search and return to their station only to find that it died in their back yard! Let us hope they will find out before the latent market now yearning for an amphibian really does die!

There always has been a market for amphibians. In fact, there has always been a good market for poor amphibians. Frankly, that is about all the American market has seen. Actually, the amphibians that have made the market in the

past have either been poorer in comparison to the equivalent landplanes of the time, or they have had such impractical layouts as to make them of little use in one of their landing elements. It has only been in recent years that we have seen really good fifty-fifty amphibians that were equally at home on either land or water.

Too often in the past amphibian designs have been conversions or adaptions of other pure designs—a procedure that at best can only result in a makeshift aircraft.

An amphibian is a compromise from start to finish and only a man with a flair for the needs of both landplanes and seaplanes—and still with a willingness to cut loose from the standard practices of both—can be expected to create a design that will be at home on land and water. In 1930 there were two amphibians on the American market in about the same class. One was a good flying boat but awkward as the deuce on land and impossible to taxi in a fair breeze. The other was a good landplane that did not even permit one to board it over the nose when at a dock—and the anchor was best handled by leaning out the window!

A smaller amphibian on the market at the same time had only a ten inch freeboard at the cockpit and could not be turned out of a fifteen mile wind on the water until one lower wing was well submerged! All three of these ships are still flying in goodly numbers, simply because there has been nothing better produced in their class. What a terrible thing to say about our proud business!

There are three very nice amphibians available today, but they all sell for above $20,000. The Fleetwings *Seabird* is the nearest to that figure, the Grumman G-21 is much more expensive, and the Sikorsky S-43 tops them at more than $100,000.

The nicest flight we have had in the past year was made in a Fleetwings on a glorious fall day. We started from the heart of New York City, flew low up the mighty Hudson River, then down the length of that pearl of beauty, Lake George, and finally into the scarlet and yellow mountainsides of the Adirondacks with perfect mental ease over the rough country. We finally dropped to the mirror surface of Upper Saranac Lake where we pulled a wing tip float up on a bed of sunny moss while we went ashore for lunch. And on the return that afternoon we flew low enough to cage the sunset behind the peaks of the Bear Mountain highlands, finally putting it to bed at the foot of 34th Street as we landed again in the East River. How silly to own any other type of plane! We had quickly refueled at an airport like any other ship.

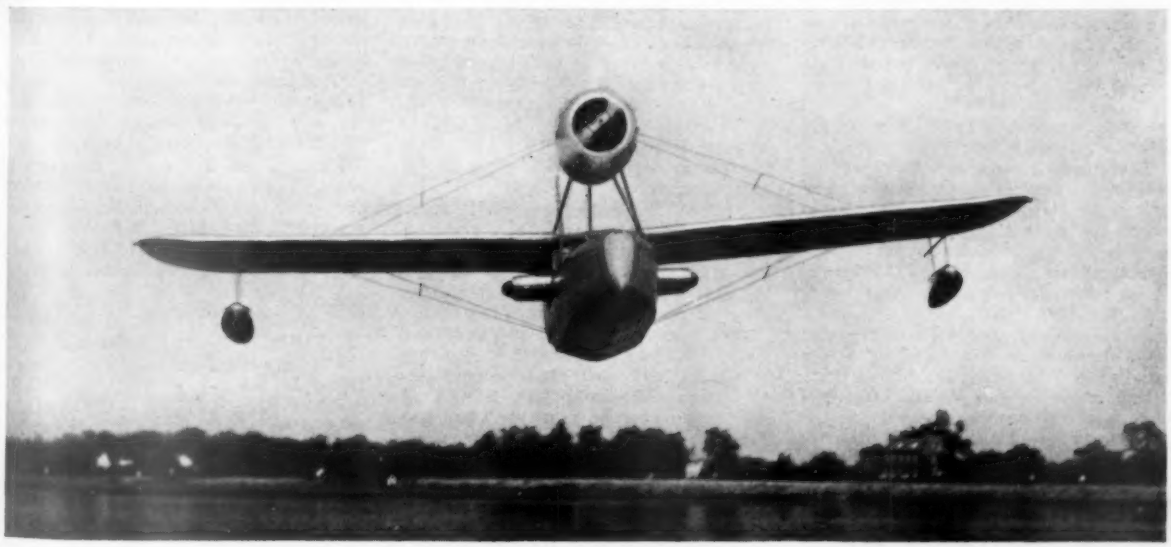
One of the most widely-used amphibians in the world is the trim Grumman G-21. Yet few private pilots could afford such a ship; the above Grumman belongs to a banker.

We badly need amphibians in the $3,000, $7,000 and $10,000 price class. Let us see what characteristics we can expect a "good" amphibian to have? Cabin room and comfort should be equal to a landplane. Normally there would be more storage space available for luggage. Visibility should be better for, with no motor in the nose, the passengers can be located in front of the wing and see all around. The noise level has a fair chance to be less with the same weight of soundproofing, for the motor is either overhead, behind—or outboard, if there are two. The Fleetwings probably is the quietest and smoothest single-engined ship in the air.

Retractable tricycle landing gears are now the ultimate desired and practically any amphibian layout with its long nose is ideal to mount the nose wheel well forward while the main wheels find plenty of retraction room behind the cabin. The retracting system is no heavier than on the landplane. Other features being equal, then, nearly equal speed should therefore be expected of the amphibian.

Considerations for water use are a little more elaborate, but no harder to accomplish. Entrance to the cabin should be provided over or through the nose and deck or cockpit space provided for anchoring and handling the marine gear. Then the deck and cabin roof automatically provide access to the rear, if a rear hatch is not also provided, and this access is needed to the center section

More like the amphibian for the private pilot is this stainless steel monoplane, the Fleetwings.



An amphibian design of a few years ago was this Ireland. For its day it was considered to be an excellent ship, although its price was prohibitive to the sportsman.

for work on the motor or for just sitting around while watching races or for fishing.

The ship must be seaworthy. This essential has often been slighted in the past. It is not a function of the hull lines (though they must be sweet), but is essentially a function of the wing loading. The larger the wing, the slower the landing and take-off speed, and therefor the greater the seas in which the boat may be operated safely. Lastly, the freeboard of the hull should be as great as practical. There is no substitute for the advantages of placing the passengers and the engine well above the water. For that reason we strongly favor the catamaran type of amphibian with two floats rather than a single hull, when the size is below 3,500 pounds.

There are a variety of good ways of making an amphibian seaplane float and landing gear combined that go neatly under a wing or fuselage. However, the ship itself must be designed for them, with no motor in the nose as in a conventional seaplane, or the whole outfit towers too high in the air when landing on wheels. The propeller must be up. An exception to this statement might be an arrangement where the floats are retracted and not the wheels, but that has not yet been adequately solved. Perhaps if the inflatable fabric floats come into the picture that may be another fruitful solution of the problem.

There is no reason that the airworthiness of an amphibian should not equal that of the best landplane. The center of gravity is invariably below the wings as in a high-wing monoplane, and the high thrustline of the motors can well be an asset in designing for good longitudinal characteristics, if it is not excessive. The long nose requires an excess of fin area but this introduces no complications in the flight characteristics, though it does add its little increment of increased weight and drag.

Now, if these are the specifications of a "good" amphibian, why should it be difficult to meet them? Admittedly, the size of the hull or the extra resistance of the floats will make the plane somewhat slower than an equivalent landplane, but the equal of a flying boat or float seaplane. Let us allow 12 per cent off the landplane. This is only 12 m.p.h. in a 100 m.p.h. cruising airplane. Admittedly too, the load will be decreased. Instead of a disposable load equal to 40 per cent of the gross, it will run more nearly 33 per cent of the gross, though good amphibians have well exceeded this ratio. If we are talking of a 3,000 pound ship, the difference is about the weight of one passenger.

All right; we'll get along with one less seat and we'll cruise 12 m.p.h. slower. Those sacrifices are well worth the exchange for the ability to use water too and, in most cases, the time lost en route will be more than restored by the opportunity to land right at the summer cottage we were bound for.

Or, if we don't wish to make those sacrifices we can pay for the difference! With 50 more horsepower we may restore that extra seat, and we will regain those 12 m.p.h. We still are talking about a 3,000 pound ship that will cost us about 15 per cent more in first cost and operating expense than the amphibian of the paragraph above, and will restore all the performance and load of the landplane we have been using as a standard. However, with the cost of hull, landing gear, etc., we may expect the final purchase price of such an amphibian to be about 25 per cent more than the equivalent landplane. And who would not pay a quarter more for a plane that will go anywhere?

Perhaps our amphibian will be made out of different material than our landplane and bring us still further benefits. The new bakelite bonded plywoods that are nearly impervious to water soakage are cheap, satisfactory, strong materials—easily repaired, versatile and look well. Sheet Alclad, as used in transport planes, results in both new expenses and new economies. Thanks to long Navy practice it can now be fabricated and protected in the process to a point where its corrosive properties are no longer a problem. Hardly so, when we learn that the manufacturer of a well-known steel tube and fabric seaplane now charges $800 to

(*Continued on page* 84)

Export Report

A REPORT issued recently by the Civil Aeronautics Authority clearly indicates that Italy and Germany have made serious inroads into our aircraft markets in Latin America and that the Orient was the principal customer for American aeronautical products during 1938. Of the total amount of aircraft and aircraft accessories exported last year —41 per cent—shipments valued close to $28,500,000 went to the Far East, as against 19 per cent, or $12,600,000, to Latin America.

German and Italian shipments of aircraft to Chile, Paraguay, Peru and Brazil in 1938 totalled $6,400,000, more than 50 per cent of all the Latin American trade secured by U. S. exporters during this period. Chile alone imported German and Italian aircraft last year worth 54 times the value of their purchases from the United States. In 1938, American exports of aeronautical products to that country were valued at $64,331, as compared with nearly $2,300,000 from Germany and $1,200,000 from Italy. Paraguay purchased aircraft from Italy in the amount of $1,000,000 and $6,162 from the United States. The Peruvian market amounted to more than 3½ times the value of equipment purchased from this country. American exports to Peru were reported worth $223,490 while corresponding shipments from Italy totalled $811,355.

Argentina and Brazil remain our best customers in the South American territory. In 1938 our shipments to the former country aggregated nearly $6,200,000 and to the latter about $2,000,000. During the same period Mexico purchased upwards of $1,200,000 in aircraft and aircraft products from United States manufacturers.

Foreign aircraft shipments from all the principal producing countries throughout the world last year were valued at approximately $150,000,000 as compared with $82 200,000 in 1937, an increase of 73 per cent during the year. The United States' share in this international trade in 1938, including all aircraft, parts, instruments, engines and parachutes, amounted to $68,200,000 or 45.6 per cent of the total, as compared with $39,400,000, or 45.7 per cent, during the previous year. Thus, while the actual value of our aeronautical exports increased 73 per cent from 1937 to 1938, the proportionate share of our world trade in aircraft remained practically unchanged.

Aircraft exports from the United Kingdom rose from $18,200,000 in 1937 to $26,400,000 in 1938, an increase of 45 per cent; while German aircraft exports advanced from $14,900,000 in 1937 to $27,200,000 in 1938, an increase of approximately 82 per cent.

The combined value of the exports from the United States, the United Kingdom and Germany last year equalled about 82 per cent of the total international trade in aircraft.

TWIN-ENGINED TIGER

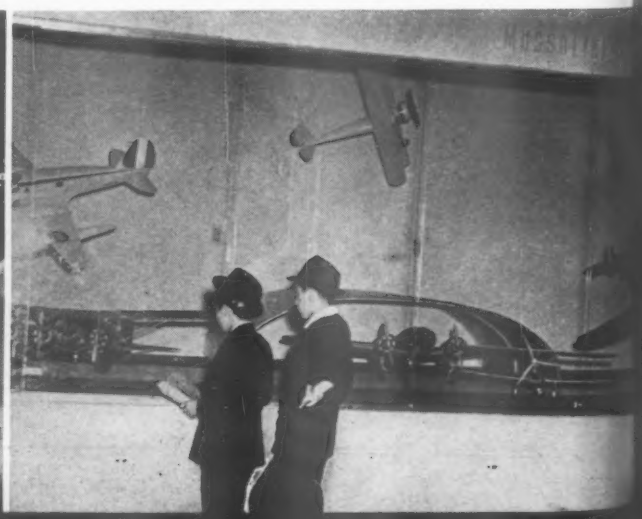
ONE way a manufacturer assures himself that his new model will be somewhat of a success is by designing it both as a commercial ship and as a military craft. Lockheed has proved this theory out quite profitably with recent designs. The ship on this page originally was the Lockheed "12" airliner. In that form its sale was comparatively slim. But the ship you see on this page is the military version, the "212" and it's a success already. At the bottom of the page is the first of 12 "212's" ordered by the Netherlands East Indies (total order: $690,000). The Lockheed people liked that start so well they built the demonstrator at the top of this page. It now is touring South and Central America looking for more customers. And its chances of getting them are good.

Air Fair

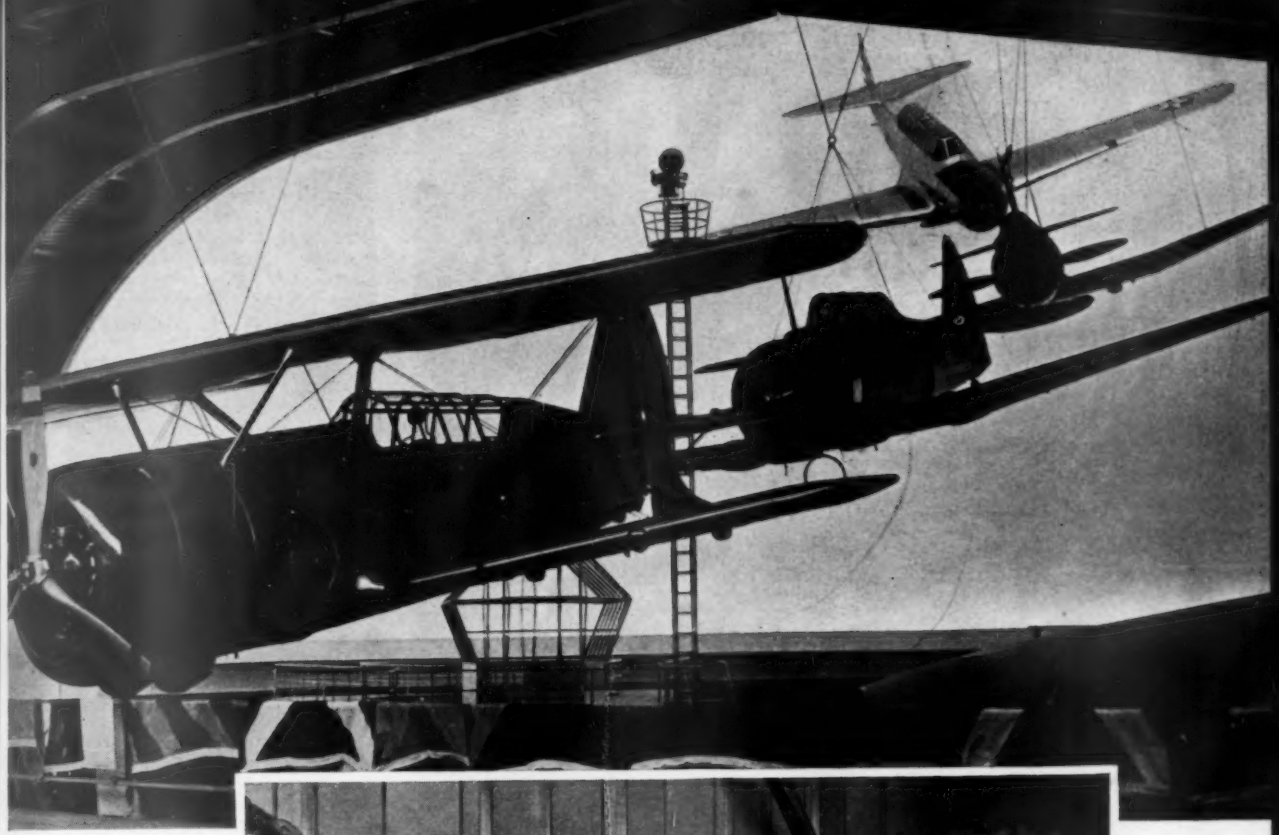
Top of page is Aviation Building. Directly above are P-36 (foreground), Brewster and CW-20.

QUITE logically, this little feature should deal with aviation's representation at both the New York and San Francisco fairs. As a matter of fact we requested this material simultaneously from our New York and San Francisco correspondents. The latter replied "there's nothing here to write about". But what San Francisco lacks New York makes up for. Housed in a special aviation building are exhibits from 12 countries with Uncle Sam heading the list with the greatest variety. Others are Britain, France, Italy, Russia, the Netherlands, Poland, Rumania, Finland, Iceland, Canada and Brazil. There is an operating Link Trainer, dozens of models, the latest in educational displays, aircraft, engines and accessories.

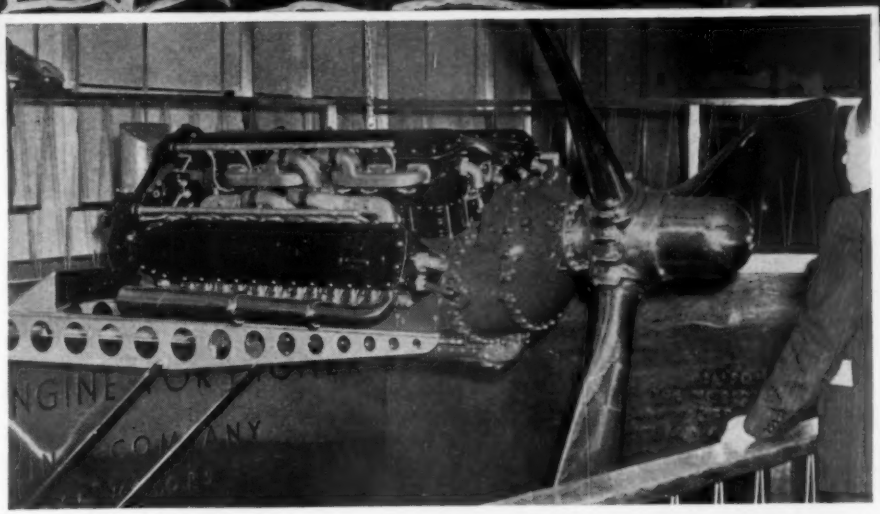
Poland's exhibit features its efficient airlines, the soaring plane that once held the endurance record; several engines.



Italy's display consists mainly of scale models. Also shown are high-powered engines, including that holding speed record.



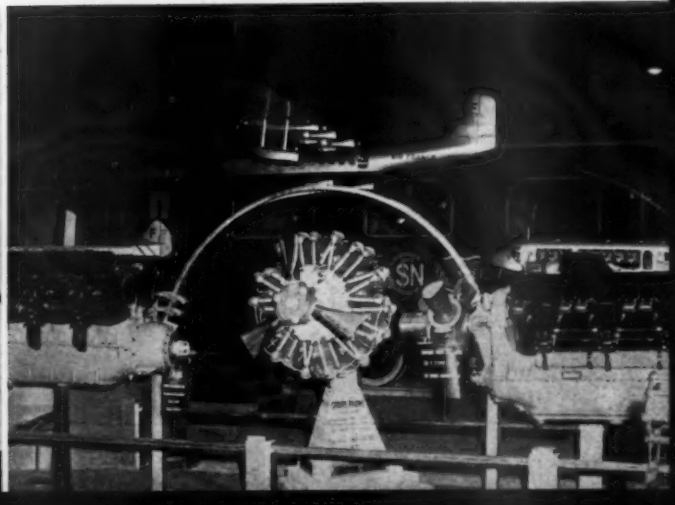
Curtiss, North American, Vought and Vultee planes "dive" at the Aviation Building visitor as he enters the front door.



This is the much-discussed Allison 24-cylinder, 2,400 h.p. aircraft engine, shown for the first time in the General Motors fair exhibit.

The airplane that flew over the North Pole, from Moscow to San Francisco, last year is part of the Russian exhibit.

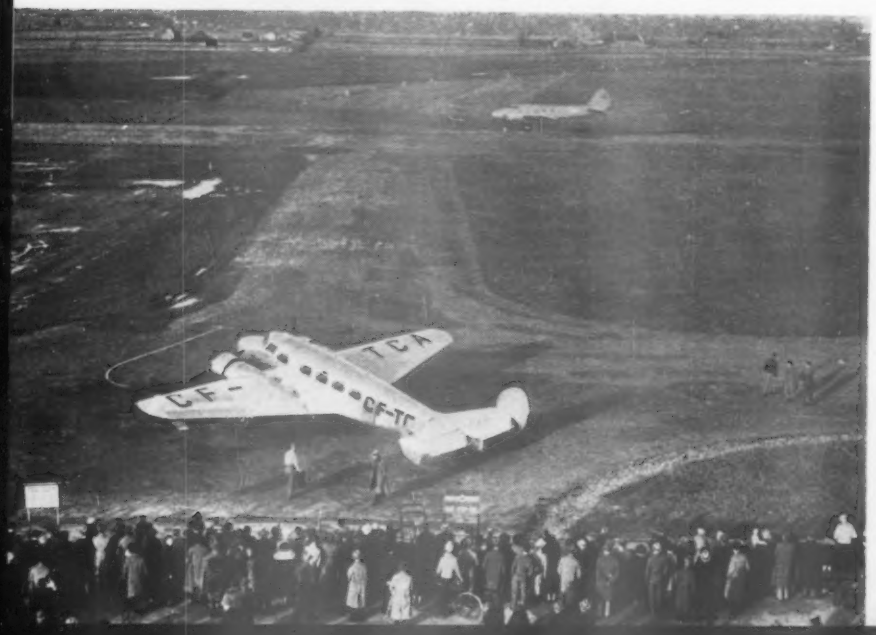
Scale model airplanes and high-powered engines (cutaway and intact) dot the large section reserved by the French.



CANADA GETS HER AIRLINE

By HAROLD H. HILLIARD

American aircraft, airline experts and methods have been combined to give Canada one of the best-equipped airlines in the world. Above is one of TCA's Lockheed "14"s.



SOMEWHERE back about 1919 a group of war flyers returned to Canada to discover that flying was so much in their blood they did not want to do anything else. Starting another war was out of the question and, although a few were able to blow off some steam in the Morocco revolt and others occupied themselves organizing the newly-created Royal Canadian Air Force, most of them were unemployed.

It was under such circumstances that a group of these pioneers banded together with the plan of organizing a trans-Canadian airline from St. John to Vancouver—a service which would probably have been the first national airline in the world. However, fate has a peculiar habit of taking a queer twist at times—and this was one of those times. It was not long before these airmen learned that such a line would be, at that time, not only technically impossible but commercially improbable.

But, over a period of six to seven years, commercial flying did actually begin to get a grounding—and the idea of a trans-continental service was kept constantly in the back of the minds of such men as MacLaren, Dickens, Kenyon and Maxwell. Their efforts brought Canada to the fore in north-country flying—work for which there was a demand and a great need. There were, from time to time, fabulous profits to be picked up—as in the case of the "dollar-per-pound days" during the Red Lake gold rush of '26—but, for the most part, it was somewhat unprofitable business.

Exactly two decades after the birth of an idea, a dream came true this year with inauguration of transcontinental air passenger, mail and express service in Canada from Montreal to Vancouver by Trans-Canada Airlines, Limited. Alongside of the group of American executives who organized the system stand two of those Canadian pioneers—D. R. MacLaren and Herbert Hollick-Kenyon—captain of the ship on two of Sir Hubert Wilkins' North Pole expeditions.

Canada, in spite of the vision of its pioneer flyers and its record as second only to Russia for air freighting, must bow down to the somewhat humiliating fact that it is among the last of the larger nations of the world to be presented with a national airline.

There may be some consolation in the fact that there is still not a trans-Canadian highway for car travellers. But the real consolation will come from the fact that, although theirs has been a long wait, Canadians have commenced east-west service under the comforts of modern flying. The pioneering has been done already, so Trans-Canada Airlines profits generously from the experience of the United States and Europe.

To one accustomed to north-country flying, this fact quickly becomes obvious, for the contrast in south-north to east-west services is somewhat comparable to the difference in rail travel between a box-car and an air-conditioned coach. The contrast is not so difficult

TCA first carried passengers between Seattle and Vancouver in small Electras.

This is the story of a major world airline that, comparatively speaking, mushroomed almost overnight. Introducing Trans-Canada:

This is the administration building containing Trans-Canada's Vancouver offices. The lusty youngster in the airline business operates across Canada from coast to coast.

to understand when it is explained that, with few exceptions, south-north air traveling in Canada is still done in aircraft that are really flying box-cars. The passengers seats are more often than not the freight cases that make up the bulk of the average payload.

The sudden transformation which has brought ultra-modern air-conditioned airliners, equipped with ultra-comfortable seats and with stewardess service that does not overlook the minutest detail, should go a long way towards quickly educating a non-air-minded Canadian populace. Instruments, too,—unknown in northern Canada flying—have added comforts; particularly as they provide for higher flying in the smoother air. North country flyers are usually kept at low altitudes by the clouds, as they must always have a clear vision of the ground below so as to not get lost.

It was just two years ago, when TCA was nothing more than an act of Parliament with its president as sole employee, that a call was sent out to an American group of flying executives to come to Canada and organize coast-to-coast air service. There was not, with the exception of Montreal, Winnipeg and Vancouver, an airport in the country suitable for modern, fast airliners; and the aforementioned three had a lot to be desired. A large number of emergency fields had been partly constructed, while there remained a string of antiquated beacon lights on the prairie, between Winnipeg and Calgary, which were used on a short-lived air mail run that had come under the mythical government axe during the dark days of '32.

Canada had many first-class pilots—but they were pilots who had always depended upon their eyesight and own good judgment in manipulating aircraft throughout the width and breadth of the country. Instrument-flying was something they had read about in books, but never actually had tried. The nation boasted two aircraft—Lockheed *Electras*—that were at all suitable for airline service, and these had been intended only for branches, not main lines.

And, from those humble beginnings, a mighty oak did grow. Philip G. Johnson, one of the papas of America's United Air Lines, came from south of the 49th parallel and assumed the vice-presidency in charge of operations. He brought with him, also from United, D. B. Colyer to be chief technical adviser; H. O. West to be technical adviser in charge of maintenance and overhaul; H. T. Lewis to be technical adviser for flying; and O. T. Larson to be technical adviser in meteorology and despatch.

S. S. Stevens was imported from Eastern Air Lines and acted first as technical adviser for communications, but more recently as superintendent. William Straith, a Canadian by birth and organizer of the first commercial company and first flying club in Manitoba, came from Northwest Airlines to act as chief pilot instructor while, more recently, he has been appointed superintendent of the western division. Only two Canadian-trained flyers, D. R. MacLaren (assistant to the vice president), and Hollick-Kenyon (superintendent of the Eastern Division), have assumed key posts.

Faced with such a superhuman task, this group of practical men really took the bull by the horns—they had to. They demanded, and got—sometimes slowly—the cooperation of Federal, Provincial and Municipal governments; the Department of Transport and various departments of the government-owned Canadia National Railways, parent company of TCA.

The first thing was to get some tools with which to work. The two Lockheed *Electras*, owned by Canadian Airways, Ltd., were purchased, while orders were placed for three more *Electras* and 10 *Super-Electras* ("14's"). The Federal Department of Transport co-operated with TCA, setting up proper meteorological services and providing range-finding stations. Federal, provincial and municipal authorities, amidst much bickering, pro-

Typical of the fine equipment set up by Trans-Canada is this modern Austin hangar and administration building at TCA's Winnipeg base. All TCA hangars were designed to accommodate larger ships.

Donald R. MacLaren, Canadian war ace who already has some 5,000 hours in his log book, is assistant to the vice-president of TCA, is taking pilot's "refresher" course.

Trans-Canada is using Lockheed "14" equipment exclusively. Veteran Canadian airmen, most of them unfamiliar with instrument flying, were trained on these fast airliners.

S. J. Hungerford (left) is president of TCA. With him is P. G. Johnson, former United Air Lines official, who is TCA's operations head. He literally set up the airline.

ceeded with the construction of airports. The Federal government rushed completion of the emergency fields.

Pilots were engaged from the principal commercial companies and trained to use instruments. TCA built hangars at Winnipeg, Lethbridge (Alberta) and Malton (airport of Toronto), while space was leased at Vancouver, Regina and Montreal.

It is of interest, incidentally, to note that TCA has profited by experience in Europe and the United States in the construction of its hangars. Allowance has been made in building plans for expansion, at a minimum of expense, of any structure to take care of the largest aircraft likely to be used in Canada as far as can be seen into the future. Already the demands upon the company's space at the chief administrative offices and workshops at Winnipeg have been so great that provision is now being made for doubling the size of the hangar.

The story of those two years makes reading which, although not uninteresting, is too long to include here. Sufficient it is to say that, on February 1, 1938, the first training schedules went into operation between Winnipeg and Vancouver. Later, test trips carried mail, then the first commercial business—air express—commenced on September 19 of last year, from Winnipeg to Vancouver. An extension of the service to Montreal and Toronto soon came. Then air mail started from Winnipeg to Vancouver and later from Montreal to Vancouver.

Thus, on April 1st—two years almost to the day from the incorporation date of TCA in April, 1937—Trans-Canada Air Lines finally qualified for both its "wings" with the first transcontinental passenger, mail and express flights from Vancouver to Montreal and Montreal to Vancouver.

Already it boasts big figures. An average of 1,000 pounds daily is now being carried, and the system is approaching its 3,000,000 flying hours mark with only one accident—the loss of a plane and two pilots during the training period. The staff has grown from one man to more than 300.

The company maintains seven-day-a-week service from Montreal and Toronto to Vancouver and vice versa as its main line, while there are several branches. One operates daily from Montreal to Toronto; another from Lethbridge to Calgary and Edmonton; and a third from Vancouver to Seattle—the latter having been taken over from Canadian Airways, Limited, in September, 1937. All branches connect with main-line planes.

Further services are operated by co-operating companies. Prairie Airways connects at Regina for Prince Alberta, Saskatchewan, while Canadian Airways connects at Vancouver for Victoria.

Future plans are of as great interest as past ones. It is anticipated that, before 1940 has arrived, the east-west line will have been extended from Montreal to Moncton, New Brunswick—another 1,000 miles east, making a total main-line of 3,500 miles. Branches will connect Moncton with Halifax, Nova Scotia, and St. John, New Brunswick.

Trans-Canada has participated finan-

(*Continued on page 74*)

Mildred Johnson is on hand at Newark airport to receive a special shipment for her Air Shopping Service. These packages might contain anything from rare gems to fish.

NOVEL LADY

by JULIETTA K. ARTHUR

Here is a woman with a prolific imagination and a great love for aviation. She combines the two perfectly.

Mildred Johnson

FOR SIXTEEN years Mildred Johnson has been busy proving that by creating new kinds of jobs in the aviation world some women can crowd more adventure into a lifetime than most men. Only aviatrix to make a flight over all the United States airmail lines; originator of one unique airhostess idea; innovator of cooperative aviation merchandise advertising; sole American woman invited by foreign companies to publicize their European flights, and now organizer of "Air Shopping," a unique service which brings you anything from anywhere—Miss Johnson's career reads like a recital of "firsts" for an aviation "Who's Who."

When you consider that she has also managed to do copywriting for an advertising agency, service at the War College in Washington, write magazine articles and children's books, it's no wonder she thinks flying is just another way of making 24 hours last longer.

It all started in 1922 when the Baldwin Locomotive Works in her home town, Philadelphia, thought so well of the 19-year-old girl that they sent her to Argentina on a two years' contract. Mildred Johnson had never thought of aviation as a means of going places until the day she found herself stranded inland when a "Big Boss" was due to arrive on a boat she was supposed to meet—some 300 miles away. She had been visiting the airport where young Canadian ex-war flyers were teaching the Argentines what flying could do for South American trade.

"How soon can you get me down to the port before the boat comes?" she demanded of the bronzed young Canuck with whom she had dined and danced the night before.

"Just watch me, young lady," said the grinning pilot. Now "borrowing" one of the government's planes was not exactly supposed to be included in Jimmy's duties and, furthermore, Mildred Johnson had never been inside a plane before. A discarded war crate is not exactly the ideal ship in which to make one's trial voyage—but she made the port with Jimmy 20 minutes before the boat docked. With that first brief adventure in the air a glimpse of her future rolled out before her, like the map of the country below her.

"I made up my mind that very day," she says, "that, somehow, I was going to get into aviation." Since that time she has flown over 300,000 miles without a single accident.

This informal shot of Miss Johnson was taken in Colombia and shows her filling an unusual order for skins.

For the exotic-minded bride the Air Shopping Service will bring Hawaiian leis and ginger blossoms by transpacific Clipper from the Islands.

The gourmet should take especial interest in Miss Johnson's Air Shopping Service. Here she is preparing stone crabs from Florida and wall-eyed pike from Canada.

Just as soon as she could get away from South America and a desk job, she came back to the United States. Magazine writing was Miss Johnson's aim at that stage in her life and she determined to use her writing to create for herself a place in the booming air industry. In between dashing off bedtime stories for a Philadelphia publishing house to pay the landlord, she began to study planes, their development, their design and construction and the various types of engines then in use. She soon became well acquainted with the foremost builders and pilots of airplanes and began turning out articles on various aspects of aviation for national magazines.

It was while visiting Roosevelt Field that she met Rear Admiral (then Commander) Richard E. Byrd. She was with the late Floyd Bennett when he brought Commander Byrd's North Pole plane from New York to the Sesquicentennial at Philadelphia. Later she collaborated with Byrd in various magazine and newspaper articles. It was through his friendship and influence that she took the rapid stride forward which put her at the head of the adventurous girls who each saw in aviation her future.

"Make aviation better known to the general public," Admiral Byrd urged.

"But how?" asked the always practical Miss Johnson.

"Be the only woman to do something with government aviation and make people get on the band-wagon and root for airmail," said this man who had every reason to know the value of being first.

It was Admiral Byrd's letter of introduction which brought the youthful Miss Johnson to the personal attention of the then United States Secretary of Commerce.

"I want to travel as a passenger on all the government airmail routes," said Miss Johnson. She is smallish of stature, soft of voice and the higher-ups are sometimes disconcerted by her forthright manner.

"No woman has ever traveled on the United States mail planes," protested the astonished Secretary.

"That's why I want to do it," said Miss Johnson calmly.

But the coveted authorization to go as observer as the first woman passenger on the 16,000 mile air tour came only after her arguments (plus Admiral Byrd's backing) had persuaded the Department of Commerce that writing and lecturing about the uses of airmail would make thousands of business firms and private individuals realize its advantages.

So, in 1927, Mildred Johnson, still in her early twenties, flew with 45 pilots in as many government planes over every one of the United States' mail routes, gathering notes for free-lance writing in five weeks' thrilling traveling.

The trip was far from dull. A violent electrical storm over the Rocky Mountains (which Miss Johnson still says was the only time she was frightened in the air), night-flying, which included one stretch of 30 hours in the cabin of a plane which made only one landing between Pasco, Washington, and Chicago, and Mildred Johnson literally returned to earth with first-hand knowledge of flying, plus a fund of enthusiasm which she immediately put to work in the cause of aviation.

Having hung up a new record for distance flying as a woman passenger, she became known from coast to coast as "The Apostle of the Airmail." For two years, before more than one hundred organizations, she toured the country, writing and talking on "How to Use Airmail." At some time during this period she took time out to learn the mechanics of flying and earn her own pilot's license.

She broke one record during her lecture tour which is not likely to be coveted by other women. She is the only girl, so far as the world knows, who has ever stood up Colonel Lindbergh. They had a date to meet at Mitchel Field, but an automobile breakdown caused Miss Johnson to miss the plane which the Colonel had to take West. Later they met at an airport near Chicago and as they stood talking—both in flying togs—a news photographer rushed up and said breathlessly:

"Mrs. Lindbergh?"

"No," said Miss Johnson, turning back to the Colonel and resuming the conversation.

"She is Mrs. Lindbergh, isn't she?" insisted the cameraman to Lindbergh.

"No," he answered, shortly, "she is not."

But when the pictures were syndicated through the country more than one caption read "The Colonel and Mrs. Lindbergh caught by the camera as they were discussing their next flight."

After two years of work on behalf of the government's mail routes there followed, in rapid succession, a promotion job with United Air Transport and, succeeding that, the mapping out of the first air-cruise for 300 American tourists over European lines. Then the Luft Hansa invited her to write for American newspapers the glories of her 3,000 mile aerial voyage over their routes.

Immediately after she returned to the United States she had another idea for a pioneering job in the air, but this time luck was against her. Because of her former exploits, she was chosen to initiate a ship-to-shore taxi service by plane in Europe. The plan was for Miss Johnson to leave the *Columbus* in the English Channel and fly to Bremen in the Junker plane carried aboard the ship. When the liner was still in the Channel, a day's run of 400 miles from Bremen, weather conditions were ideal. But later, on inspecting the plane, the pilot found that its constant exposure had made its use somewhat hazardous, especially as there had been no chance for testing it.

Disappointed, Mildred Johnson nonetheless resolved, while still in Europe, to be the only woman among the crew of five scheduled to fly freight and mail from New York across the Atlantic by the now almost-forgotten Rohrbach-Rostra flying yacht.

When she called at their office, the Rohrbach officials in Berlin had certainly never before encountered that particular type of American woman's determination.

"I want to be the first girl to fly as a passenger across the Atlantic," she said matter-of-factly.

"But we are not planning to have any

(*Continued on page* 78)

Stunters Caught

THE Civil Aeronautics Authority has suspended the student pilot permits of two flyers charged with stunting over the high school at Murray, Utah, on April 24. The two, Samuel Gagian of 242 West 48 South St., Murray, and Roy J. Morris, of 5492 State St., Murray, were ordered to show cause before Glenn D. Woodmansee of the Authority's enforcement section, at a date to be set by him, in Salt Lake City, why their licenses should not be permanently revoked.

"There are too many student pilots doing such fine work in the pilot training program sponsored by the Authority," Chairman Robert H. Hinckley said in announcing this action, "to allow irresponsible students to get away with anything like this. Wherever necessary the Authority will proceed against reckless private flyers.

"This case was brought to the attention of the local inspector for the Authority by the police of Murray and the school faculty. It seems a particularly flagrant one. Busy as our inspectors are in the field these days, they will welcome complaints against any such wild flying and we will proceed against the pilots responsible wherever the facts justify it."

In the present instance the local authorities reported that Gagian and Morris hired a Piper *Cub* and a Waco from the Salt Lake City airport and, flying eight miles to Murray, proceeded to stunt over the school and the children outside of it. Gagian is charged with repeatedly diving at the school and its surroundings, barely missing a forty-foot flag pole and flying 200 feet above the road. He also was reported to have done wingovers, dives and stalls at low altitude, all in violation of the regulations against acrobatics at low altitude, over congested areas and without wearing a parachute.

Flying Teletype

WHILE official and social Washington paid their respects to the king and queen of England, a handful of Government and commercial aircraft engineers observed the first practical demonstration of the Civil Aeronautic Authority's new radio-teletype developed on ultra high frequency. The device, which permits teletype reception aboard an airplane of weather reports and other messages teletyped from ground stations, is the work of the radio development section of the Civil Aeronautics Authority under the direction of Chief Engineer W. E. Jackson.

It was demonstrated aboard plane NC-13365, United's "flying laboratory", and the group observing the performance of this new development was the Radio Technical Committee for Aeronautics, comprising the leading radio experts in the field of air transportation and manufacture, as well as Governmental officials. It is just a matter of time until these instruments are adopted by the nation's major airlines.

WHO'S WHO ★ IN AVIATION ★

The aviation industry long has needed its own, exclusive Who's Who. It is the hope of POPULAR AVIATION that it can fill this demand through the use of its peculiarly suited facilities now being employed in the production of each issue of this magazine. The following brief biographies merely are the beginning of this feature. Additional and more complete listings will appear in future issues. It is intended that the aviation industry eventually will be supplied with an invaluable reference work containing pertinent facts concerning as many important members of the industry as space permits.

ABRAMS, TALBERT. Now head of the Abrams Aerial Survey Co. at Lansing, Mich. Not only has the Abrams company specialized in aerial photography and map making, but it has designed a special type of airplane to suit its peculiar requirements. Mr. Abrams was born in Kenosha, Wis., August 17, 1895, flew with the U. S. Navy and Marines in 1918-19. He then joined the engineering department of the Curtiss Aeroplane and Motor Co. In 1921 he returned to Michigan, where he has conducted his own business since. Today he holds Commercial License No. 599.

ADDEMS, WALTER JOSEPH. Present division flight superintendent of United Air Lines, based in Chicago. Generally considered one of the most capable men in the entire aviation industry, Addems insists on remaining in the background and shuns publicity. His hobby is the building of model airplanes—and he has built some masterpieces. Addems was born in Loda, Ill., on January 10, 1899. He has been flying since 1915 and served with the U. S. Army in 1918-19. From that date on he was engaged variously in barnstorming (1919-23) and in manufacturing (Yackey Aircraft Co. 1925-27). He now lives in Riverside, Ill., and holds Airline License No. 965.

ALLEN, EDMUND TURNEY. Recently appointed chief test pilot for the Boeing Airplane Co. at Seattle. Best known for his test-flying and engineering work on the Boeing "314" *(Yankee Clipper)*, Sikorsky XPBS-1 and, lately, the Boeing "307" *(Stratoliner)*. Allen was born in Chicago on January 4, 1896, and attended the University of Illinois and the Massachusetts Institute of Technology. He worked with Major R. W. Schroeder in his test squadron at Dayton in 1919, achieved renown in gliding by competing in soaring competitions in 1922 in Europe. Flew airmail for several years. Now holds Commercial License No. 2148.

ANDREWS, FRANK M. Commanding General of the G. H. Q. Air Force, Langley Field, Virginia. Major-General Andrews has been in the Army Air Corps since August 5, 1917. He first joined the Army as a second lieutenant in the cavalry in 1906. He was promoted to a captaincy on July 15, 1916, then transferred to the Air Corps in 1917. He commanded the advance flying school at Kelly Field, Texas, during 1926-27. As this is written he stands 370 on the entire Army promotion list. He also holds Commercial License No. 32476.

ARNOLD, HENRY H. Now major-general and Chief of the U. S. Army Air Corps, was a student of the Wright brothers at Dayton, Ohio, from April to June, 1911, and a pilot and instructor at College Park, Md., from June to November, 1911. Held many posts since that time and was promoted to his present position following the death of Major-General Oscar Westover. Major-General Arnold was born in Gladwyne, Penn., on June 25, 1886. Though 53, he still is an active pilot.

ARNOLD, LESLIE P. Vice-President of Pennsylvania-Central Airlines. Started aviation career in Army Air Corps and was with the First Aero Squadron with the Army of Occupation until July, 1919. Was a test pilot in 1920, became famous in 1924 as a member of the Army's Around the World Flight in 1924. He resigned after 10 years, turned to real estate and investments and finally to commercial aviation.

BEHNCKE, DAVID LEWIS. President of the Air Line Pilots' Association. Was for several years a pilot for United Air Lines, resigned to become head of the ALPA, an American Federation of Labor affiliate. Was first commissioned in the Air Corps in 1918 and later discharged at the close of the war. Operated several commercial aviation projects and once returned to the Air Corps for a short period. He no longer flies actively. Mr. Behncke was born in Beaver Dam, Wis., on May 1, 1897.

CROSSON, JOSEPH ESLER. Famed Alaskan airman. Started flying in 1923, instructed students and did commercial flying in California in 1925. Went to Alaska in 1926, where he has been ever since. Achieved a great deal of fame as a "mercy" pilot noted for his rescue flights into the far north. Now an official of Pacific Alaska Airways, a subsidiary of Pan American Airways. Born in Kansas on June 29, 1903, Crosson now holds Commercial License No. 1643.

DAMON, RALPH SHEPARD. Vice-President of American Airlines. Formerly an official of the Curtiss-Wright Corporation, Damon got his start in the Army Air Corps as a flying cadet. Now

(Continued on page 84)

This is a typical load of freight going aboard an old Fokker to be flown into the north woods.

ARCTIC FREIGHTERS

by JAMES MONTAGNES

Things have come to a pretty pass when housewives must do their shopping by airplane. There isn't much else they can do about it in northern Canada.

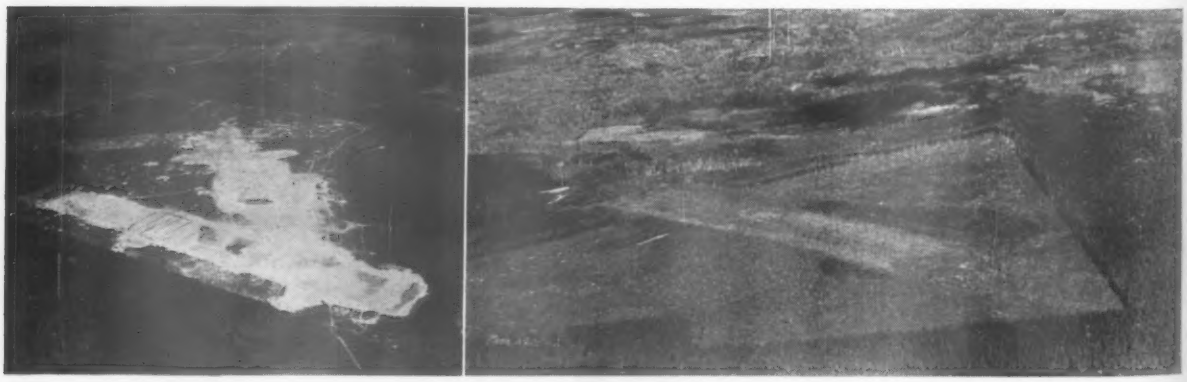
WHEN you want groceries, you go to the grocer around the corner. In northern Canada the airplane pilot is the grocery man. Here is a report from a Manitoba pilot, typical of reports of Canadian pilots who fly north of the railway lines in the new mining regions:

"Called at Jackpine Bay to pick up grocery order as per instructions."

That afternoon he landed at his base 100 miles to the south, handed the grocery order to the base manager who telephoned the local warehouse and, by 5:30, the grocery order was piled up in the shed awaiting aerial transport.

The next morning three planes were loaded with the order—cases of oranges, sacks of onions, cartons of coffee, fresh meat, jelly powders, cornflakes, jams, canned fruits and young live chicks. Within 24 hours of picking up the grocery order the pilot had it at the camp, everything fresh. Nearly as fast service as if the mine were next door to a city, instead of being a hundred miles from the railhead and hundreds of miles north of the

Below are two improvised airports hacked out of the dense forests so that supply planes can land.



nearest city where supplies are available.

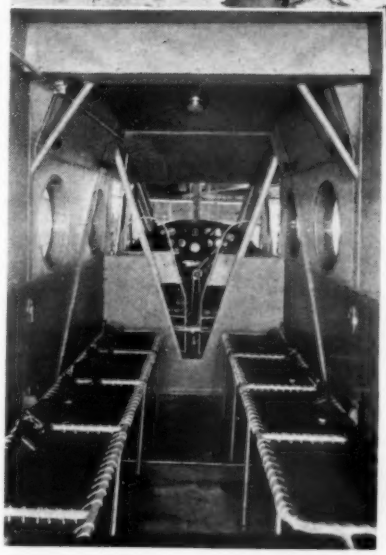
If airplanes had not been available it would have taken several days for that grocery order to come to the railway. It would have taken a motor boat an 80-mile trip with provisions back, transfer to canoes, 15 portages over slippery moss, deadfalls, muskeg, not to mention heat, big black flies, mosquitoes and discomfort. It would have taken over a week to get those provisions to the mine, and they would no longer have been fresh.

Airplanes have cut down the cost of living in northern Canada. Because of the heavy overhead on overland transport, miners' wives used to have a hard time making the weekly paycheck cover potatoes at $10 a bag, canned foods at 65 cents a tin, sugar at 50 cents a pound. The airplane stepped in. Today prices are down, with potatoes at $3 a bag, flour at $4.80 a bag, sugar 15 cents a pound and canned fruits 30 cents a tin. Aerial transport saves time and money.

Airplanes now are especially built to suit Canadian freighting conditions. These aerial freighters are provided with large batches sometimes on top as well as on each side for ease in loading and unloading. The hatches are wide enough to allow boiler sections, hoisting winches and other bulky mining machinery units to be carried with as little dismantling as possible. The machines are designed to have as large a capacity as possible while keeping in mind the ability of the crew to handle the ships at remote points where no assistance can be expected. Freighters with payloads up to 2½ tons on floats are plying the northern skyways.

Besides groceries Canadian aerial freighters carry ton-weight ore buckets for mines, portable gasoline engines for lighting plants, sections of diesel engines, sections of rock crushing mine mills, lumber, furniture, nitroglycerine, nails, drums of fuel oil, live pigs and cows, sleds and canoes, equipment for radio stations, all manner of building materials, steel rails, household goods—in fact everything needed in opening up a new region to civilization and the gold mining industry.

Prospectors and their supplies usually are flown "in", picked up weeks later.



Above is the interior of a big freighter. Passenger comfort is sacrificed for space.

Among the freighters' varied cargoes are gold concentrates (below) from the mines.

The latest official government figures show that Canadian air transport companies carried in 1937 three times as much freight and express as carried by all United States airlines—including not only those in the continental United States, but also all lines in the territories and all lines operated by United States air companies in Central and South America. Canadian air transport operators carried in 1937 over 26,000,000 pounds of freight and express, more than 13,000 tons of light and heavy merchandise went by the air route to sections of Canada not served by any other method of year-round transportation. To about 30 Canadian air transport operators sky freighting is the main reason for existence.

All this tonnage is flown in regions where there are no lighted airways, where towns and villages are scarce, where lake and river and bush all look the same. Pilots of the aerial freighters have to rely largely on landmarks, on their self-drawn maps, for accurate maps are not available for much of the northland. No radio beams aid the airmen on these sky freighters in fog and darkness. Few of the planes are radio equipped and radio stations are scattered at great distances only at principal outposts and the larger mines. Some of the air operators have their own radio stations to dispatch their planes, give their pilots weather reports and to take orders for freight and passenger traffic.

Many are the difficulties encountered through the changing weather conditions. Pilots have hopped off in the face of an oncoming blizzard against the advice of men who knew the country and have beaten the storm. Planes have

This is a typical Arctic community, being visited by an aerial freighter. The ship is an American Fairchild; the majority of planes used in the Arctic are American.

This Bellanca freighter has just landed with a cargo of passengers and freight at Great Slave Lake in the North West Territories. Every ship uses floats, wheels or skiis.

These two airplanes are unloading supplies from a steamer at Yellowknife. This is a mining headquarters and the supplies will be flown to more remote mining outposts.

This Canadian-built Noorduyn freighter has just landed on the ice of Lake Athabasca with freight slated for a nearby mining camp. Notice the milk, ice cream and soap.

gone in with pontoons because when they left the base the water was still open. They have been frozen in overnight, to be chopped out and refitted with skiis before further flight was possible.

Special means of heating engines in winter, of keeping oil from freezing, and of making repairs when needed have been devised. Portable stoves are carried by big planes on remote runs, tarpaulins are part of the emergency equipment, so that a pilot can throw a cover over the engine, tack it down to the ice and put his stove in to heat up the engine. Repairs have been made in 50° below zero weather on the Arctic coast. Portable nose hangars are a common sight on all ice landing fields. Portable stoves keep the engines thawed out overnight in those wooden, tarpaulin or even ice block nose hangars.

Despite all difficulties sky freighting to the sub-Arctic and Arctic is becoming annually a bigger industry. Most of the Dominion's 400 commercial planes are used for freighting, a field of aviation developed only during this decade. Little more than 10 years ago the first prospectors used planes to get to virgin, undeveloped mining territories. Today the aerial freighters fly more than 6,000,000 miles a year to deliver merchandise in the far north and bring back the products of the country. Operators who started on a shoestring with obsolete planes a decade ago, today have fleets of modern planes, carrying millions of pounds of freight and express as well as passengers and mail.

While mining is mainly responsible for most of the freight carried by air into the Canadian Arctic and sub-Arctic considerable tonnage is flown for Canada's oldest industry, the fur trade. The fur companies, large and small, are using the airplane extensively for inspection purposes, saving weeks of ardous travel for their inspectors. Heated planes make fur inspections easier, faster and more frequent during the trapping season. The use of the plane, air operators reveal, has resulted in the opening up of new fur trading posts in points inaccessible before, but in good trapping regions. Especially is this true of northern Ontario, where new posts are being opened in regions hardly ever touched by native or white trappers.

Several times a year a large Canadian air transport operator speeds a cabin plane to a secret northern destination. There two trappers meet the plane with bales of fur. They are trapping in the No Man's Land of the Canadian Arctic, too far inland from the coast for the Eskimos, too far north of the tree line for the Indians. One of the trappers goes with the plane and takes the furs to market at Edmonton. Then he flies back with supplies, traps, reading material and food. His partner takes the next trip. They lose no time on the more than a 1000 mile trip from their trapping grounds to Edmonton. Modern, they use the air.

The airplane has meant the difference between profit and loss to the fur trappers in these days of low fur prices.

(*Continued on page* 68)

THE STRESSED-SKIN FUSELAGE

by GEORGE H. TWENEY

The day is not far off when all aircraft, even lightplanes, will be built entirely of metal. This article discusses one factor.

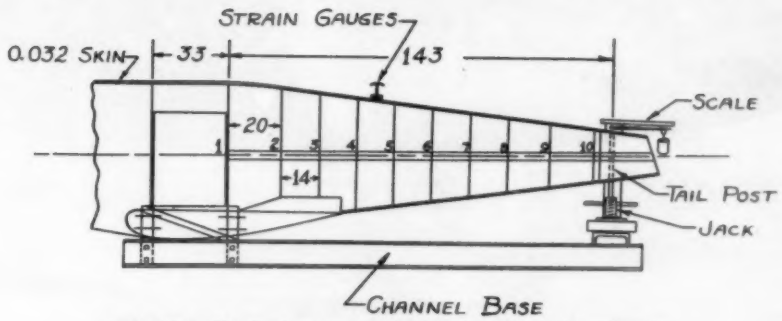


FIGURE 1. This fuselage is on its back to facilitate load application.

THE building of stressed-skin metal aircraft structures is becoming a much more common practice now than in the past, and we may soon reach a time when all aircraft will be built of metal. The lack of trusted experimental data has greatly hampered the design and building of metal structures. The theory is, to begin with, very complicated, and there are still many phases of it which are not completely understood. The value of full-scale tests on monocoque structures is thus very great, since it is only by testing a full-scale model of a certain structure, that a true measure of its value is obtained. Collections of such data also enable one to predict the characteristics of a geometrically similar structure, without the actual details of a laboratory investigation.

Metal fuselages of the shell type are rapidly gaining favor in current airplane design. The advantages of the shell type of structure are many for aerodynamic and structural reasons. The shell type of structure of cylindrical form or otherwise is the strongest for the least weight, and offers minimum drag for a given head on area displacement.

Monocoque or shell type fuselages rely on the strength of the skin to carry either the shear or the loads due to the bending moment. They may be divided into three classes: reinforced shell, semi-monocoque, and monocoque. In some designs, different portions of the same fuselage may be in any one of these classes.

The reinforced shell has the skin reinforced by a complete framework of structural members. The semi-monocoque has the skin reinforced by longerons and vertical bulkheads, but has no diagonal web members. In the true monocoque the only reinforcing members, if any, are the vertical bulkheads formed of structural members.

The theoretical monocoque type is shown in Figure 3, illustrating a ring bulkhead with lightening holes. The lightening holes do not detract structurally from the strength of the shell,

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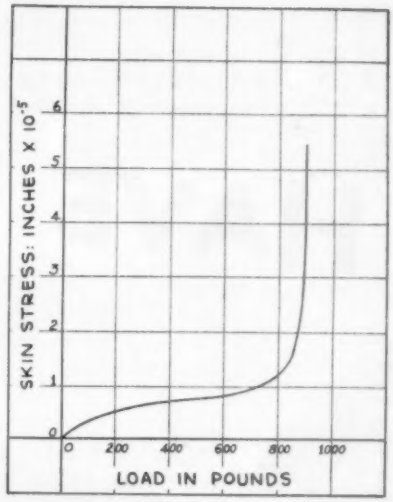


FIGURE 2. Variation of skin stress.

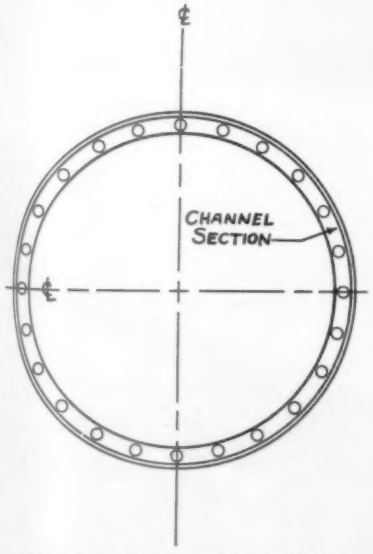


FIGURE 3. A theoretical ring bulkhead.

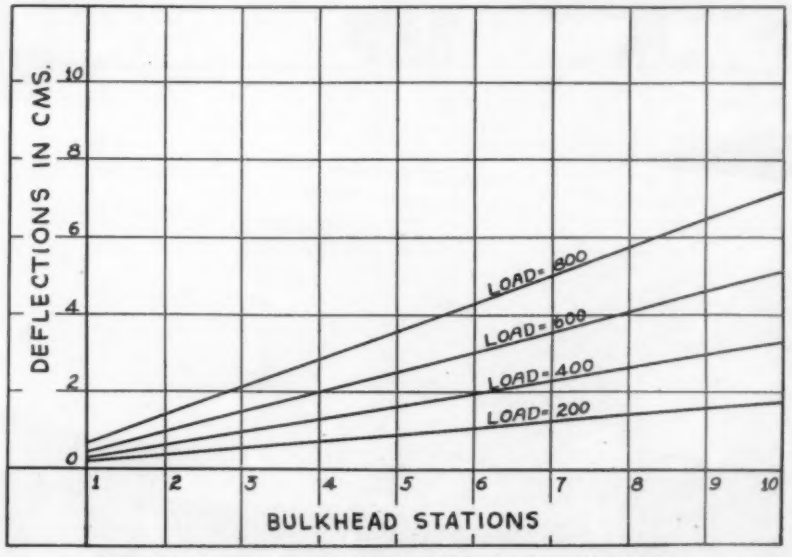
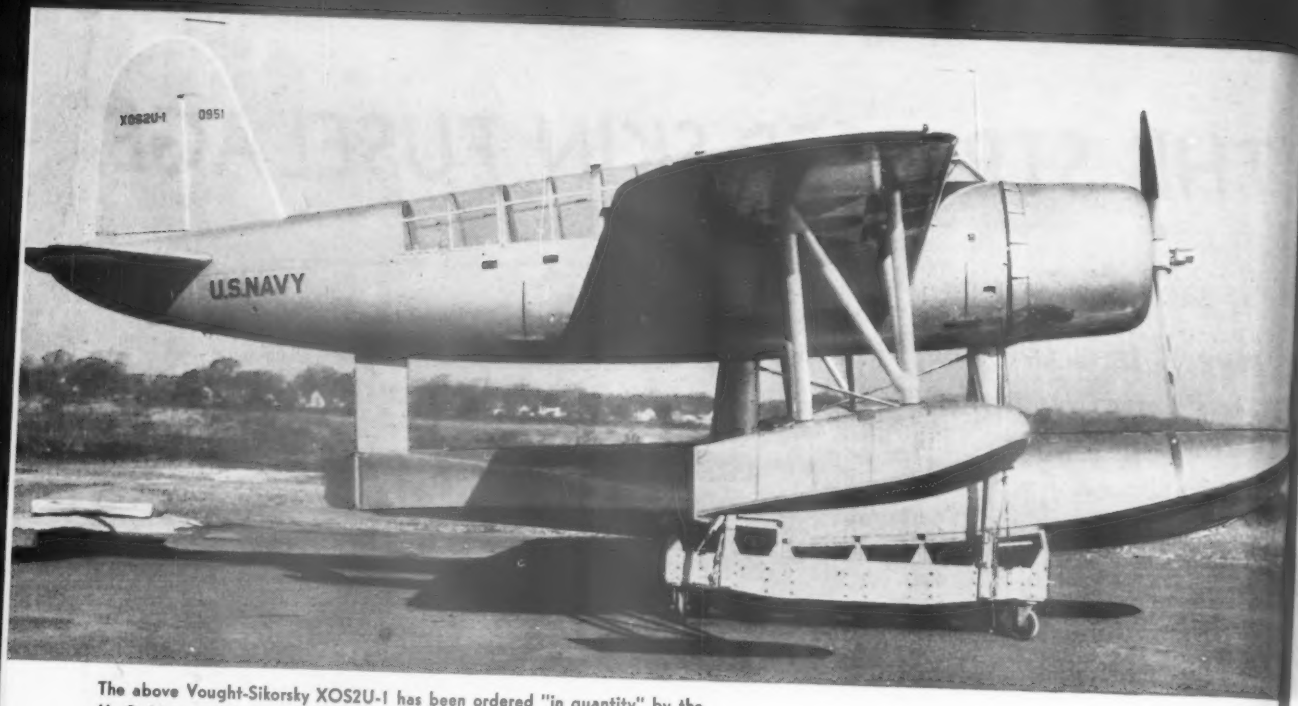


FIGURE 4. These are the data for the actual deflections of the fuselage.

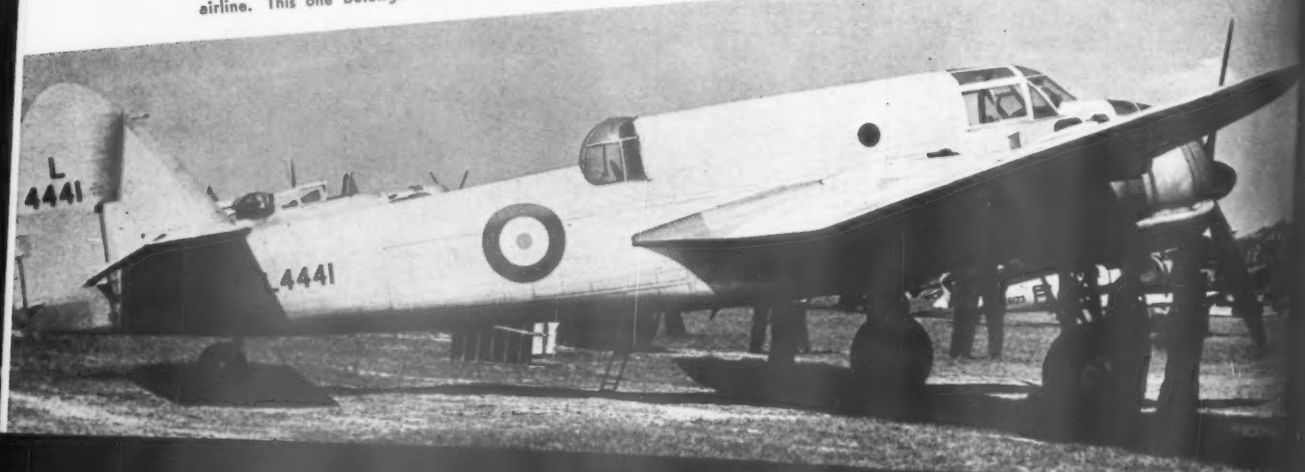


The above Vought-Sikorsky XOS2U-1 has been ordered "in quantity" by the U. S. Navy. It is powered with a 400 h.p. engine, is intended for catapult use as a scouting-observation ship. The Navy bought $2,103,800 worth.

HAVE YOU SEEN . . . ?

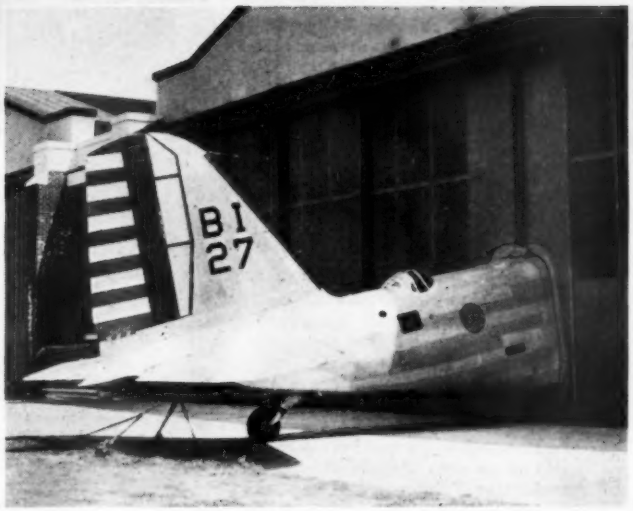
One doesn't often see a Douglas DC-2 anywhere but on an airline. This one belongs to the Nevada Exploration Co. ↑

↓ Britain now calls this new Bristol Beaufort "the world's fastest bomber". It is powered with two 1,065 h.p. engines.



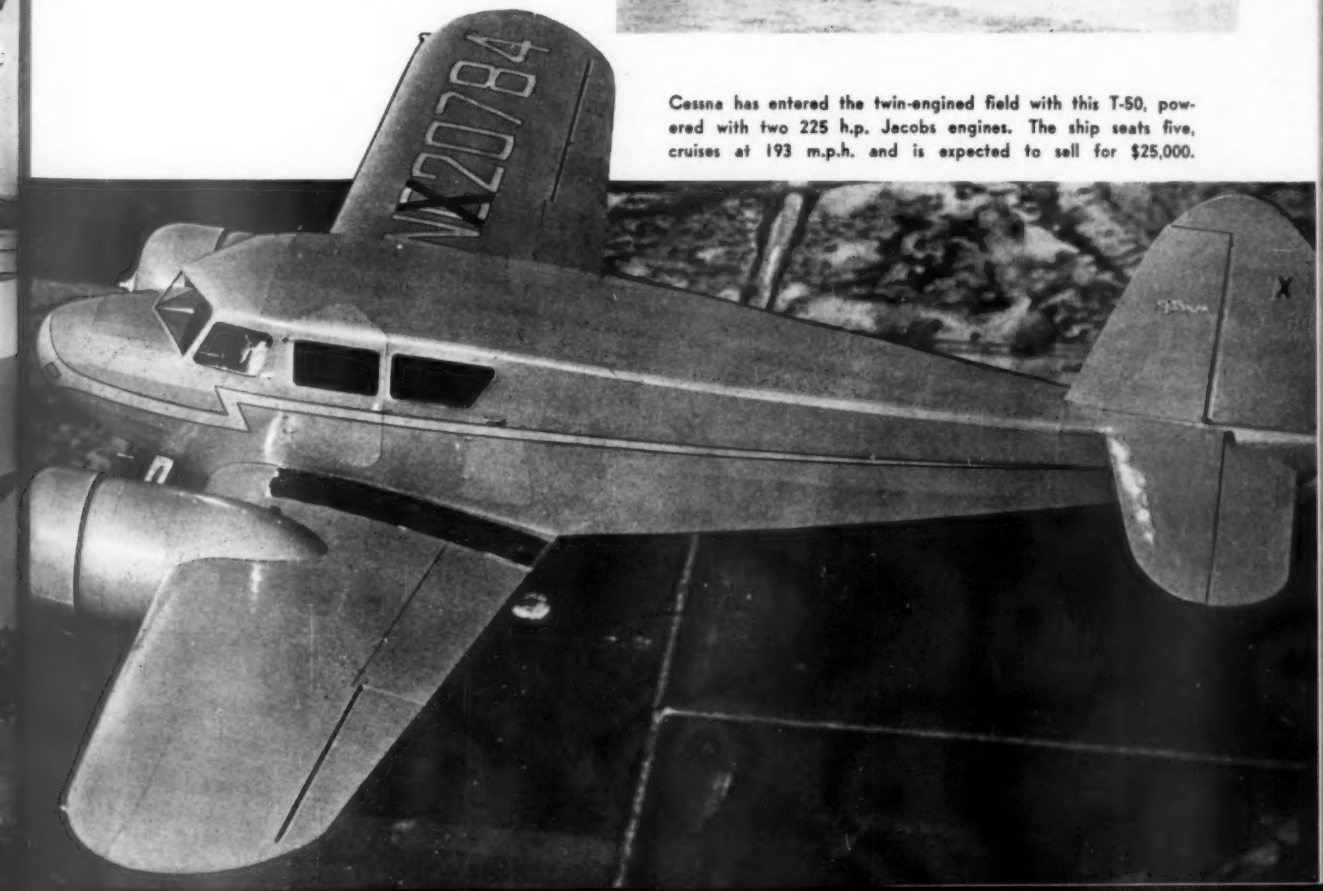
This is the first of 20 Vought scout-bombers to be completed on an order from the French government. Similar to the U. S. Navy's SB2U's, they will be based aboard a new French carrier.

★



Army bombers got bigger but the hangars at Mitchel Field, N. Y., didn't. In order to get three B-18A's into one hangar, holes have been cut in the doors. The protruding tail is staked down.

Cessna has entered the twin-engined field with this T-50, powered with two 225 h.p. Jacobs engines. The ship seats five, cruises at 193 m.p.h. and is expected to sell for $25,000.



Violations

THE Civil Aeronautics Authority recently ordered two private pilots to show cause why their certificates of competency should not be revoked for violations of the Civil Air Regulations. This was the first such action to be taken in regard to private pilots since the creation of the Authority.

Norman John Leavitt of El Monte, California, holder of a solo certificate, was charged with violating the regulations prohibiting a solo pilot from carrying a passenger other than a certificated instructor; with permitting a passenger to occupy a control seat in an airplane when the controls are functioning, and with flying at an altitude of less than 500 feet. The C. A. A. inspector reported that in attempting to land his plane, Leavitt overshot the field, pulled up in too steep a climb, fell off and spun in, crashing into a large willow tree adjacent to the El Monte airport. The airplane was completely demolished and both Leavitt and his passenger sustained serious injuries. Date of hearing in this case was postponed because of the condition of the men.

Samuel Hart Giberson, who holds a limited commercial certificate of competency, was charged with leaving the Denver Municipal Airport on December 11, 1938, carrying three passengers, for a sightseeing flight over the city, without sufficient fuel or oil aboard to complete the flight, taking into account the wind and other conditions he had been advised he would encounter. Shortly after takeoff he ran into a snow squall and was forced down in a populated section of the city of Denver, landing between two rows of dwellings. Neither Giberson nor his passengers sustained other than minor injuries.

The C. A. A. is taking action against all such cases brought to their attention.

Airline Houseboat

FIRST-CLASS hotel accommodation for airliner passengers night-stopping at Mozambique in Portuguese East Africa will shortly be provided on board a tug now being converted into a luxurious houseboat by Imperial Airways.

The vessel, the *Richard King*, will be moored at Lumbo. It was formerly operated by the South African government at Durban Harbor. A small army of carpenters, plumbers and interior decorators are converting it into a floating model of a modern Piccadilly hotel. There will be accommodation for 30 passengers and staff with electric light, electric fans and hot and cold water in each cabin. There will also be a lounge, dining room, bar with counter and refrigerator, cold storage room for food supplies, and completely equipped galley and pantry.

The *Richard King* will be the second houseboat in Imperial Airways' ground organization. The other is the *Mayflower* situated on the Nile at Rod-el-Faraq, Cairo.

A Model Amphibian

A MODEL builder in Los Altos, Cal. has good cause to be proud of his prowess as a designer and builder, if we are to judge from his letter and the accompanying photographs. The model is the product of the efforts of Peter Bowers of Los Altos. It is powered with a one-tenth horsepower *Brat* engine. Wing span is 50 inches and the total weight is 20 ounces. "The ship was built to take a beating", Mr. Bowers writes. "Its best demonstration of that was a 200 foot power dive into a lake when the coil broke loose and slid forward. The only damage was to the pilot's cabin . . ." The hull is two-step, has vents and is of all-sheet balsa construction.

The Flying Mounties

WHEN Canadian lawbreakers go modern, so do the famed Royal Canadian Mounted Police. This De-Havilland *Dragonfly* is one of a fleet of airplanes now owned and operated by the Mounties on the Atlantic and Pacific coasts as well as those shores of the Great Lakes that are in Canada. The ships are being used to check on smugglers and rum-runners and they already have proved their worth several times over.

THE Man UNDER THE Hood

FRANCE has admittedly purchased some 40 flying boats in this country . . . but **French** officials in this country have, to date, refused to name the company from which they purchased them . . . but a little off-the-cuff mathematics by those in the industry who should know seems to indicate clearly that **Consolidated Aircraft** at San Diego has just come into a most welcome windfall . . . it's no secret, of course, that **Consolidated's** PBY patrol boat so popular with the U. S. Navy has been offered—in an export version—to any person or country interested . . . even **Britain** has purchased one "for tests" . . . other PBY-model owners besides the Navy are **American Export Airlines** and Richard Archbold, the wealthy young explorer. . . .

* * *

Speaking of **American Export,** we're inclined to wonder a little at that report that AE is thinking of a trans-continental air-freight line . . . in addition to its soon-to-be-surveyed trans-atlantic routes . . . an air-freight line might not be a bad idea . . . at least several experts in the industry like it . . . **Benny Howard** already has gotten quite a bit of publicity in connection with a proposed hinged-tail twin-engined freighter he intends building. . . .

* * *

Benny Howard, by the way, had an interesting time with **Orville Wright** at Dayton, Ohio, the other day . . . occasion was the arrival of the **DC-4**—with Benny, of course, at the controls . . . **Mr. Wright** seemed fairly cold and aloof about things in general . . . he was introduced to **Howard** and invited to climb aboard for a ride . . . which he did . . . the difference in **Mr. Wright's** outward appearance when the ship finally landed caused persons on the airport to grin a little . . . he hopped out of the giant airliner just bubbling over with enthusiasm . . . he pumped **Howard's** hand heartily in thanks for the ride. . . .

* * *

Here's an interesting little item that surprised even us . . . although it might be logical . . . we're passing it on for what it's worth . . . a certain smaller manufacturer, intending putting a new airplane on the market, is said to have purchased a standard model from another manufacturer with whom Manufacturer No. 1 fully intends to compete . . . said builder then is said to have ripped up his competitor's airplane, added a few bulges and streamlinings here and there, then re-covered the job . . . that, we're told, is the airplane that manufacturer intends marketing . . . the story is that all one need do nowadays is produce a ship with a different appearance which automatically—from a legal standpoint—makes it a new type airplane. . . .

* * *

The C. A. A. accident report on the crash of that experimental **Boeing** *Stratoliner* in March is an extremely interesting thing to read . . . as to the cause of the accident in which 11 engineers lost their lives, the report lays the blame on structural failure following a sudden pull-out from a fast dive . . . which, of course, should not be done with any airplane that size . . . it also was disclosed that the pilots at the controls at the time of the accident had comparatively little experience at flying that particular airplane . . . the co-pilot —a representative of the Dutch government inspecting the ship for possible purchase by KLM—had only had a *total* of 160-odd hours of flying experience to his credit . . . which is amazing. . . .

* * *

Those slots which caused such comment throughout the industry when they were installed on all **Lockheed** "14"s now are being installed on many of the **Douglas** DC-3's in this country . . . let us hasten to add that this casts no reflection on the airplanes; the slots merely are another safety device and every progressive American airline wastes no time in getting such proven devices installed on its ships. . . .

* * *

The mention of the name **Douglas** calls to mind another one we heard in connection with the DC-3 . . . we understand that it will be possible for the Douglas company to convert the present DC-3s to DC-6s if their owners wish it. . . the **DC-6** basically will be a four-engined (medium horsepower engines) tricycle-geared airliner . . . the story is that the present DC-3 is admirably suited to being switched over should the airlines so desire. . . .

* * *

Getting back to the **Lockheed** "14", it's said that the **British** government has purchased all the planes of this model owned by **Northwest Airlines** (Chicago - Minneapolis - Seattle) . . . although the "14" is quite a nice airplane as it stands, it is understood that **Northwest** has found the need for airplanes with more passenger capacity . . . and consequently have purchased several 21-passenger DC-3's . . . the **British** will convert the "14" to **Hudson** bombers. . . .

* * *

Then there's the report that the **Army Air Corps** intends equipping the First Pursuit Group over at Selfridge Field, Michigan, with new high-powered interceptor fighters . . . we don't know exactly what make interceptor will be purchased . . . but it probably will be something like that phenomenal **Curtiss** ship built at St. Louis . . . we do know that this ship has been undergoing tests at Wright Field . . . **Vultee's** also reported to have an interceptor design on tap. . . .

* * *

The airlines are sitting on pins and needles over their "scrip" (air travel cards) setup . . . the C. A. A. has called a hearing as to the legality of scrip in any form . . . due largely to the efforts of travel agents and other ticket sales people who claim they have been deprived of thousands of dollars in commissions because of the use of scrip . . . any organization holding a scrip account gets 15 per cent off the published airline fares . . . a scrip card holder merely steps up to the airline ticket counter and signs a receipt for his transportation, which subsequently is billed directly to his company . . . this, of course, eliminates the "middle man" or ticket agent . . . the complaining agents have given the airlines something to worry about, however . . . they have hired potent lawyers and have gone to work in Washington with a vengeance . . . the airlines admit they can't afford to lose scrip . . . generally speaking, we'd say 25 per cent of their business comes from that source. . . .

"Well?"

From where we sit it looks like **Jacqueline Cochran** will not fly in the much-touted **Bendix Trophy Race** this year . . . neither, we hear will **Col. Roscoe Turner** . . . nor **Ross Hadley** . . . which, we fear, will give **Cliff Henderson** and company something to ponder . . . because the **National Air Races** can't afford to lose any of its star attractions . . .

* * *

The **Bendix** company has perfected a system of fuel injection for radial engines . . . it provides increased power, new fuel economies, eliminates the carburetor and consequently icing troubles . . . it's ideal for military planes because violent maneuvers, inverted flying and similar tricks have no effect upon the functioning of the engine . . . the fuel, with the system, is injected directly into the intake manifold at the supercharger . . . United Air Lines, the Army and Navy are experimenting with it. . . .

* * *

Where do you suppose the most consistently unstable weather conditions are found in the United States? . . . along the transcontinental airway between Denver and Grand Forks, Neb. . . . no matter what the rest of the great plains' weather may be, Grand Forks has its two old reliable thunderheads . . . **United's** pilots have come to recognize them as regular airway markers—and to name them . . . the cumulo-nimbi are "Tweedle-Dee and Tweedle-Dum" to **United's** crews . . . so far the twins are about even for violence and general hell-raising with sedate airliners. . . .

* * *

Laura Ingalls expects to fly to Europe this summer in a Barkley-Grow . . . she's in Detroit now flying the ship and taking some navigation instruction . . . if the CAA turns down her application for a waiver she expects to fly it non-stop to some distant South American city . . .

* * *

Within the next year several new gadgets for light airplanes will go on the market . . . some of them include a controllable-pitch propeller with wooden blades, priced for the owner of small airplanes; an inexpensive electrically-operated turn and bank indicator operated from dry battery current and capable of being switched on and off at will so that current will not be wasted when the indicator is not needed; a light and inexpensive rate of climb indicator that will displace the expensive instruments that now are universally used by the Army, airlines and those who have enough money to equip their airplanes with all the instruments. . . .

* * *

As you know, San Francisco's **Treasure Island** is intended to be an ultra-modern air base as soon as the present exposition closes and the island can be cleared for runways . . . however, we have it from good authority that officials of the two major airlines operating into Frisco have told city officials that they will not set up their base on **Treasure Island** unless an additional 1,500 feet of runway is available in all directions. . . .

END

Japanese Warplanes on a Raid

JAPANESE bombers continue to wreak havoc in China. If it has been proved nowhere else in the world, air power has been revealed in all its ruthlessness in China. The two photographs of Japanese warplanes shown here were taken from accompanying planes in the same squadrons. The ships were on their way to a raid somewhere in China at the time.

Because the Japanese are so wont to copy anything and everything that looks good to them, aviation people in this country usually conduct a sort of game in connection with any new airplane the Japanese produce. The game consists of trying to identify the various foreign types (usually American) from which the Japanese version has been made. On that basis, then, we'd say the ships at the top of the page have a touch of Vought and Boeing to them. They are two-place fighters equipped with wing bomb racks for small ground-strafing missiles.

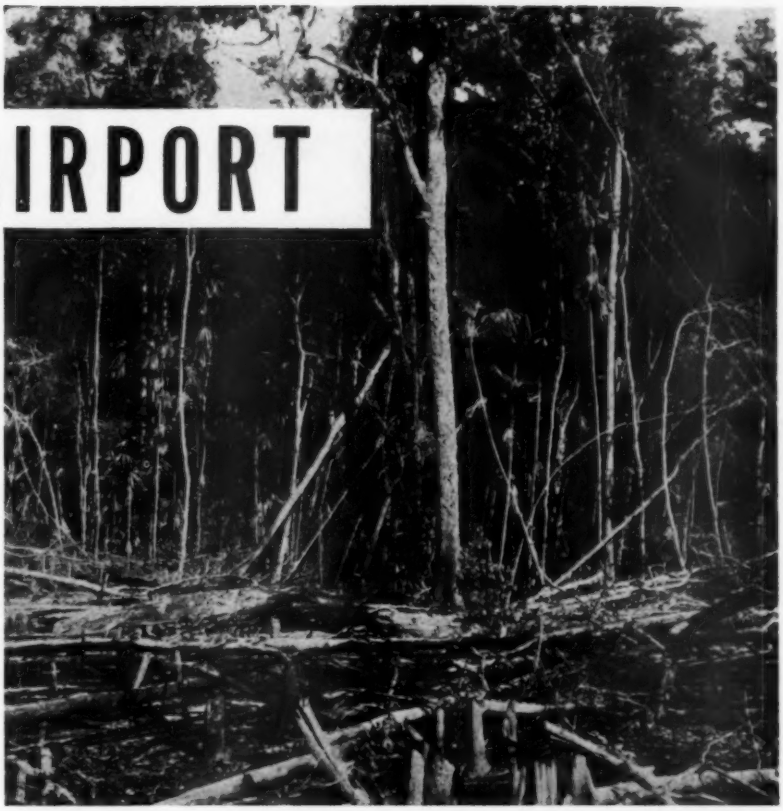
The low-winged monoplanes at the bottom of the page are the deadlier warplanes of the two types shown. They appear to be close copies of an American Northrop attack-plane design. Generally speaking, Japanese warplanes follow German, British or American designs that have proved particularly successful in their homelands. While the two types on this page happen to resemble American designs, the Japanese heavy twin-engined bombers that have carried the brunt of the attack over China are strikingly similar to German designs. The Nazi influence, however, is not just coincidental; the Japanese have been getting German aeronautical advice—unofficially, of course. Nazi-style equipment and methods are being seen oftener.

JUNGLE AIRPORT

by RALPH HANCOCK

Photographs by the author

They don't have our flat plains down in Central America. To get an airport they must hack it out of the dense jungle inch by inch.



This is the beginning of a typical Central American landing field. The dense jungle must be sawed, hacked and blasted open. The large tree in the center produces chicle.

THE man from Texas was more surprised than anyone. That was probably because he was born and raised on those broad open plains where a tree is a phenomenon. But there are few who realize or ever stop to think that there might be any of the romance and adventure connected with airport construction like that which has always been associated with the flying part of aviation.

Down in Central America the audacious phrases "Flying the Jungle Run," "Volcano Hopping," and "Working the Chewing-gum Route," have lost their tang in the everyday run of prosaic business. Because, hauling more freight than any other single airline in the world, 25,000 pay passengers a year, and 1,500,000 miles of flying annually is business—big business. But it doesn't take a long haired poet to see the romance back of these figures, no matter how serious the pilots and the officials, and the other members of the organization take their jobs. Transportes Aereos Centro-Americanos, Ltd., TACA as it is familiarly known throughout the Central Americas, has a history as interesting as any young air transportation company that has lifted itself by its own sky-hooks during the past ten years. But the favorite songs in ever case have been to the glory of the fearless and intrepid aviators. I saw a jungle field opened up, cleared off and the ground smoothed out for these intrepid people the other day and since then hung my spare halo around the scapegrace brow of another kind of adventurer.

Lowell Yerex, TACA head, poses with Colonel Ponce, Peten governor of Guatemala.

But before we get too deep into the life and problems of the jungle airfield engineer, let's find out first why he has to build airports in such god-forsaken places. Joe Silverthorn, who heads up the new field construction in the Guatemala Division of TACA, says you can blame it all on the 50,000,000 stenographers in the United States. (Ciphers are always added onto American figures. The magnifying glass called "American Tourist" causes that.) But whether the stenographers are at fault or not, certainly the millions of gum-consuming people throughout the world chew enough every day to put chicle gathering on a big time basis. Chicle, as you may or may not know, is the foundation on which your stick of chewing gum is built. And chicle is the sap from the zapote tree and the zapote tree grows in the tropics and Guatemala has a wild, unexplored area called the Peten, (largest unexplored area in the North American continent) full of zapote trees.

Before TACA made the big chewing gum companies a proposition, chicle came out of the jungles on mule-back. Four weeks was the minimum time for a trip from the chicle concentration points to the coast. TACA makes the round-trip now in as many hours and can take 3,000 pounds of chicle out every trip. The mules have been given permanent leave and Joe Silverthorn the job of hacking out airfields in the heart of the wild Peten. And what with trees and vines and tropic jungle vegetation so thick one cannot see fifty feet in any direction—including up—that is some job. No wonder my companion from Texas was astounded.

The tremendous task and the great amount of work and expense involved in opening up a new field in this country is difficult to imagine. A general location is chosen after consultation with the chicle gatherers as to the most advantageous place nearest to their forest camps. Then Lowell Yerex, boss of the TACA outfit, takes Silverthorn with him in his own private Bellanca and they

This tri-motored Ford freighter has brought in a rotary shovel and scraper to be used in the surfacing of a jungle airport. Note how ship's fuselage has been changed.

fly over the area. By close scrutiny of the terrain below them and careful study of the prevailing winds, they pick a final location and mark its direction and probable distance from the nearest field on their maps. Later, with a crew of 50 to 75 men, tools, food, medicine and light equipment loaded on mules, Silverthorn starts the long trip into the chosen area. Finally a camp is made and test lanes are cut through the dense jungle growth to determine the best location. Within a few weeks palm thatched houses have been constructed and much of the preliminary clearing on the field has been accomplished. The trees are felled and piled and as soon as they are dry they are burned. The huge stumps, left in the ground, then are split open with dynamite and burned out. Since most of them have no tap roots and the wood is highly resinous, they burn out easily after a week or two of drying in the tropic sun.

In less than two months the field is ready for Yerex to make the first landing and personal inspection. From then on it is only a matter of a few days before the huge tri-motor freighters start making regular stops. On their first trips in, large grading equipment, caterpillar tractors, oil, and gasoline are brought and the final surfacing of the field is completed. The stump holes are filled in and huge plows scratch out the stray roots. Rotary scrapers take down the humps and make adequate drains on the edge of the field.

All of which sounds commonplace enough. Red-headed Joe Silverthorn would resent any inference to the contrary, but a few sidelights on the construction of a jungle airport would probably be interesting and you can use your own imagination for any romantic or adventurous interpretations.

Loading a tractor into the belly of an airplane is not an unusual sight in Central America. This usually is the only way airport-building machinery can be gotten in.

Carnegie Institute archeologists have estimated that many millions of people must have inhabited the Peten during the height of the ancient Mayan civilization. Great temples, beautiful palaces and fine castles, surrounded by large cities, were scattered throughout the area. Think then of the vast acreage that must have been under cultivation to supply the needs of these people. A wealth of produce must have been grown every year to feed so many, but today there are very few acres in the Peten not completely covered by a dense tropical growth so impenetrable only a faint trail here and there is open to land travel. From the air one can see the bright green tops of countless thousands of mahogany trees, the darker green of the zapote from which comes the valuable chicle, giant cedars, dye woods, ceibas and guanacastes.

But from the ground this is another thing. To the men fighting their way through the bush with a slow, heavily burdened mule train, it is just a pain in the neck—and other places. Very little of the sky can be seen at any time and it is with a sigh of relief that the first trees are felled and an opening to the sun and freer air is finally made.

The *barba amarilla* (yellow beard), the most deadly of all Central American snakes, is plentiful and much in evidence; alligators must be killed in the water holes or at least shooed to the other side before one can take a bath or get a drink in safety. Mosquitos make the nights hideous and a brand of tropic tick works the day shift.

But there are compensating factors. Savory wild game, especially deer, wild turkey and tapirs are plentiful. Gaudy birds, giant butterflies, delicate orchids and an endless variety of wild flowers are on every hand. Nearly every field so far opened has cut through a low mound or two, all that remains of a once beautiful temple or the castle of a Mayan noble. And breathes there the man whose soul is so dead he cannot follow the scraper with an eagle eye for the bits of pottery and jade and obsidian objects invariably turned up?

When TACA first began to fly the Peten run two or three years ago, there was only one field. This was at the ancient village called Flores, almost in the exact center of the Peten territory. Flores has for many years been the concentration point for chicle from all over the Peten. Since the establishment of service to Flores, four new "feeder" fields have been cleared and put in regular scheduled service. Paso Caballos, in the western part of the country; Uaxactun, near the old Mayan ruins of the same name; Dos Lagunas, near the border of the Quintana Roo territory in Mexico; and Carmelita, in the heart of the swampy lake region of the Peten. Seven thousand feet long by about 500 feet wide, with 25 foot wide drainage ditches

(*Continued on page 78*)

LOCATING THE THRUST LINE

by RAOUL J. HOFFMAN

THE location of the thrust line relative to the center of balance is one item in airplane design that has been greatly neglected. Although adjustable stabilizer and elevator are devices that would permit location of the thrust line at any point, pilots would prefer airplanes with the least amount of adjustments.

Controlability of an airplane depends on many factors. One of them—longitudinal stability—is indicative of easy control forces. However an ideal airplane would be one that could fly "hands-off" by operating only the throttle, and one that would also glide to the ground at the least sinking speed after the engine is shut off.

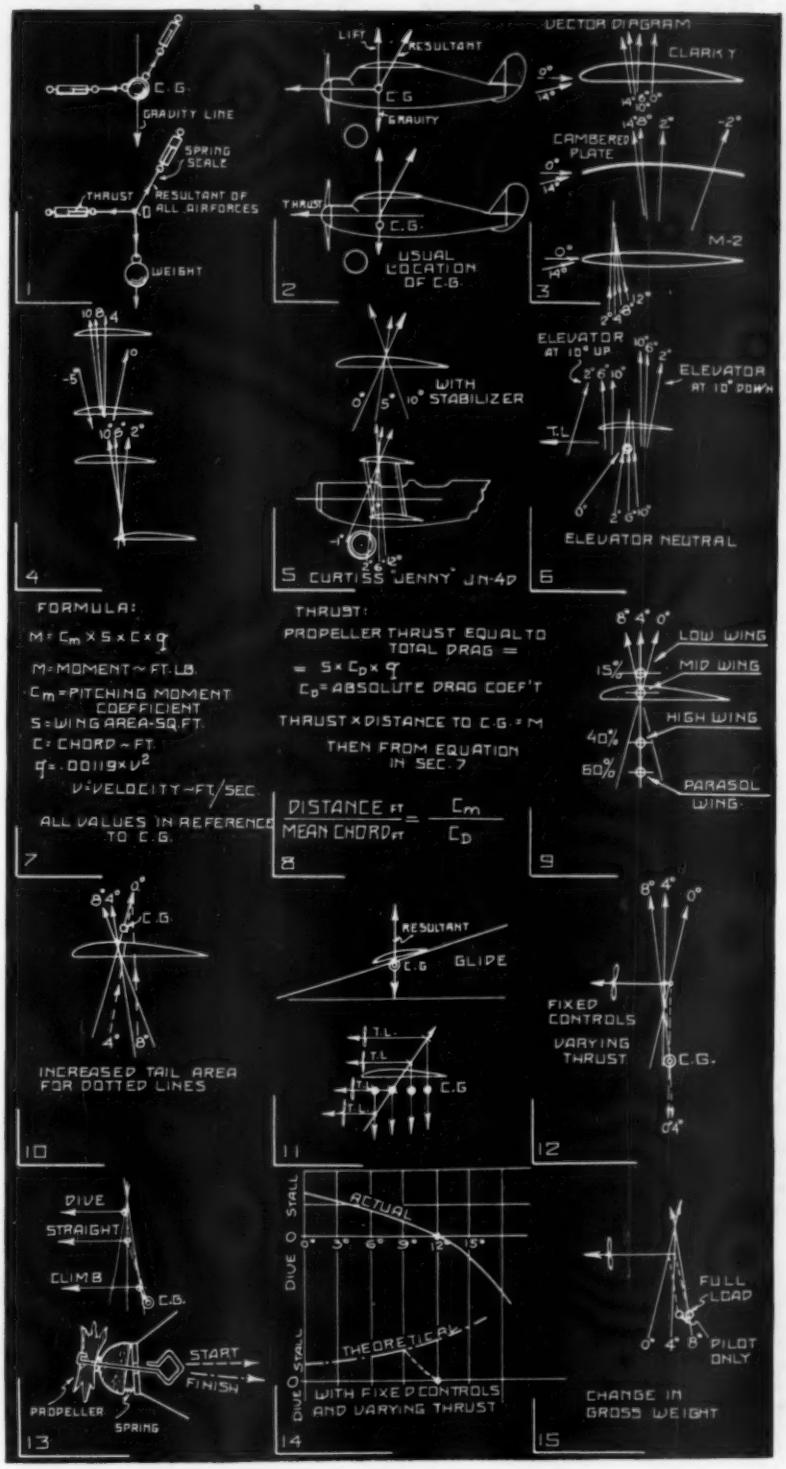
For investigation of the location of the thrust line, graphic representation of the forces involved are more comprehensible than equations and their derivatives.

The sketch in Section 1 shows two spring scales supporting a weight and a vertical line indicating the direction of the gravity forces. The loads on the spring scales would not change if the same weight is fastened at any distance below the intersecting point 0. The whole system of forces will always be in balance if the forces meet at the same point. This combination of forces is similar to the three main forces of a stable airplane; the resultant of all air forces, the gravity force of all weights concentrated at the c.g. (center of gravity) and the thrust of the propeller. Section 2 shows in the upper sketch how the three forces meet at the c.g. and in the lower sketch the usual arrangement of the forces.

However an airplane will not fly at all speeds with the same forces and with the same direction of forces. First the different attitude of the plane changes the gravity line. Then the propeller thrust varies with speed and the resultant of the air forces varies with the angle of attack and speed.

Locations of the resultant air forces at various angles for the Clark Y wing section, for a cambered plate and for a streamline section are shown in Section 3. For two biplane combinations see Section 4. Section 5 has one sketch of the forces on a wing with a stabilizer and the other sketch shows the vectors for the Curtiss "Jenny". Another interesting diagram is illustrated in Section 6 and shows what happens to the resultants when the elevator is set at the up and down positions.

It is obvious from the sketch in Section 6 that the c.g. may be placed at various points and the airplane could be trimmed by the action of the elevator. An airplane in order to be stable must have forces that will restore it to its original position after it was disturbed. That is, in case the airplane dives, the



forces for smaller angles must be ahead of the c.g. and, in case the airplane stalls, the forces for greater angles must lie behind the c.g. This implies that the resultant forces should move numerically from the leading edge toward the trailing edge.

The various positions of the resultants create a pitching moment which is equal to the magnitude of the resultant times the shortest distance of the c.g. from the resultant. The farther apart the greater the moment. However, too great distances will make it hard on the controls.

The regular formula used in text books is noted in Section 7. A formula in combination with the propeller thrust and the distance from the center of gravity is evolved in Section 8, by making the moment created by the propeller thrust equal to the moment of the air forces. This again shows that the propeller axis will seldom pass through the c.g. of the plane.

Section 9 shows the usual vector diagram and the various locations of the c.g. of a parasol-wing, high-wing, mid-wing and a low-wing design. It shows the low-wing is not stable for the resultants are in a reversed numerical order. It also indicates that a parasol design is a more stable airplane. However, the low-wing designs are not a low-wing in a strict sense, for the dihedral used places the mean chord in a mid-wing position. Also a carefully designed stabilizer may reverse the position of the resultants as sketched in Section 10.

Without propeller thrust the plane will glide downward, its resultant in line with the gravity line as shown in Section 11. With propeller thrust, the c.g. must be placed so that the three forces are in balance as seen in Section 11.

An ideal condition is drawn in Section 12. The location of the c.g. is so that when the gravity lines are drawn they intersect the vectors at points through which a straight line may be drawn. This line could be the propeller axis. With this arrangement of forces the pilot could fly the ship on an even keel by operating the throttle only and by locking the controls.

In an average design the vectors are located as sketched in Section 13. Raising the thrust axis will cause the plane to dive and lowering it will make it climb. This adjustment was tried years ago with an adjustable motor mount, but it was found out that the elevator control is more effective.

Model builders, however, are using this adjustment of the propeller axis by placing a small spring at the nose block that will give a high thrust line at the start and a low one at the finish of the flight, the variation actuated by the tension of a wound rubber motor.

Section 14 shows the average of a commercial airplane with a zero moment at 12 deg., at an angle it will glide. The lower curve gives an ideal pitching moment curve for an airplane to fly with throttle only. The equation in Section 8 was used in calculating and plotting it.

Another problem that upsets some of

(*Continued on page* 80)

Automatic Weatherman

THOUGH a comparatively new instrument for the accumulation of weather data, the radio meteorograph already is in wide use by the Government weather stations as well as those of the various airlines throughout the country. The radio meteorograph is completely automatic and already is well on its way toward uncovering a few mysteries of the upper air regions.

The device consists of a balloon with an automatic radio transmitter attached. The entire affair weighs two pounds and can be carried aloft by its hydrogen-filled balloon to altitudes ranging from 12 to 15 miles. The tiny radio transmitter is sensitive to changes in air pressure, relative humidity and temperature. As the device ascends (approximately 600 feet per minute) radio frequency signals which depend upon changes in the sensitive meteorological elements in the transmitter are received by an automatic radio recorder at the airport station.

Due to the many problems encountered in the use of these instruments, coupled with the high degree of technical skill required in the manufacture of the devices, the United States Weather Bureau entered into a novel method of cooperation with the manufacturer of the instruments. The manufacturer leased the transmitting and receiving equipment for a period of one year during which time the responsibility of accurate calibration and perfect recording were placed on the manufacturer, while the use and application of weather data so obtained became the problem and responsibility of the Weather Bureau.

The radio meteorograph represents the culmination of research which had taken

nearly 10 years to reach its present stage. Paralleling the efforts of the Weather Bureau to obtain an ideal instrument for upper-air weather investigations, the U. S. Navy and the Bureau of Standards, working with the original manufacturers, developed the original model. What their labors will mean to the future of aviation which, experts agree, lies in the stratosphere, is hard to tell. It already has proved of great value, even to present-day airline operations.

The balloon which carries the instruments aloft expands in the upper rarefied atmosphere and finally bursts, allowing the entire device to float to earth on a parachute. They may reach the earth anywhere within a radius of 150 miles from the point of release. A reward of $1 usually is offered for their return.

Personalities

Walter Hamilton recently resigned as TWA operations head to join Douglas Co.

Dean Smith, veteran airman formerly with American Airlines, is with Curtiss Co.

Rae Rambeau, 19, of Los Angeles, is training to become an aeronautical engineer.

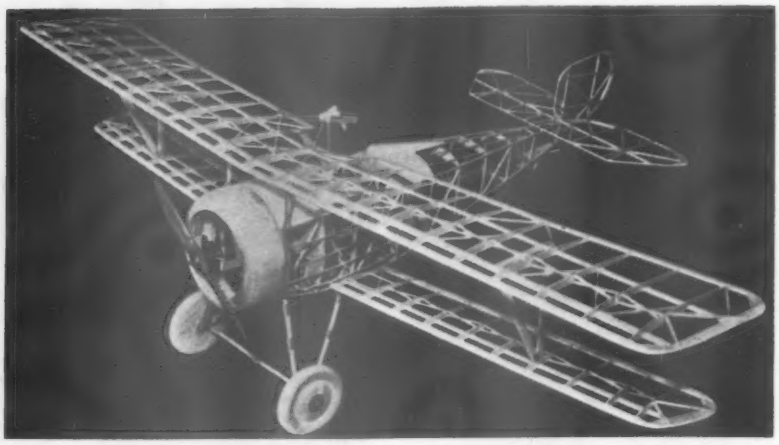
Clara Johnson, United stewardess, has flown 2,000,000 miles in nine years.

Johnny Jones, lightplane record holder, now is an American Airlines first officer. →

Mrs. Theodore Phillips of Cambridge, Md., recently flew her ship on Florida cruise.

"Miss American Aviation", selected at Birmingham, is Hostess Katherine Wilson.

Tiny Leo Schmitz recently flew to New York then sailed for Europe—all alone.



The broad wing area of this model makes it especially good for all-around performance.

THIS MONTH'S MODEL

by PAUL W. LINDBERG

Model Editor and Designer

REQUESTS for a World War model have been so numerous that we have drawn up the plans for the Nieuport "17". Our chief purpose in selecting this particular model was of its correct amount of wing area suitable for a gas model. Note the short nose which will give it exceptionally good climbing qualities. When flying the model substitute the wooden wheels for 2¼ inch diameter rubber tire wheels. This particular model is colored ali yellow with a red cowl. All insignia are standard French colors. You may build any size model you wish by enlarging the plans to whatever size you desire. Our model is built by enlarging the plans four times the size shown here.

Building the Fuselage

The main longerons are ⅛-inch square hard balsa. Build the two fuselage sides upon a flat surface and when they are thoroughly dry cement in all cross members to form a rectangular-shaped body. The formers are next cemented into position. These are cut from ⅛-inch sheet balsa. The landing gear is now fastened in position and is held securely in place with heavy thread and cement. 1/16-inch O.D. piano wire is used for landing gear struts. Fair the landing gear with ⅛x¼ inch hard balsa. The axle is held in struts with rubber bands to act as shock cord.

Construction of Wings

It is very important that all bracing be installed in each wing panel as shown in photo of framework. If these braces are omitted the wings will warp out of shape when covered. All wing tips are made from ⅛-inch sheet balsa.

Elevator and Rudder

These are constructed upon a flat surface from ⅛-inch square and ⅛x¼ inch plus ⅛-inch sheet balsa for all rounded parts. These are of a flat type and no trouble should be had in the construction of these.

Motor mount, cabane and wing struts plus other details are clearly explained on the plan. The machine guns are, of course, optional and serve only as an ornament when used as a display model.

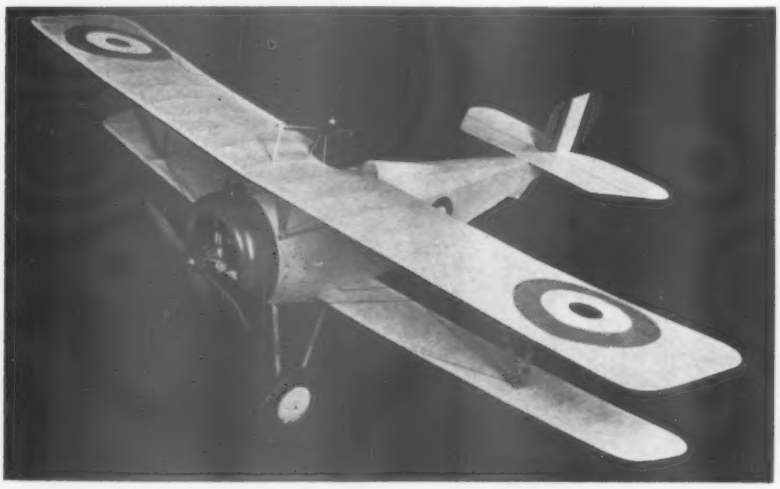
Covering the Model

Use a good grade of bamboo paper in covering the model. All parts should be covered separately before assembling the model. After the wings have been covered, spray with ordinary water in order to obtain a drum-like tautness in the covering. Pin the wings, elevator and rudder upon a flat surface with ordinary pins to prevent same from warping. After they are thoroughly dry, three coats of model airplane dope are applied with a light sanding between each coat. When installing wing to fuselage, use heavy thread or thin wire for landing and flying wires.

Testing the Model

When testing your model see that it is equipped with batteries, fuel, etc., Launch over tall grass so as to prevent any injury to it when gliding. If model rises abruptly, move batteries forward in rack. If it noses down, move batteries toward rear. Aluminum tabs are used in both wing and rudder so that directional and rudder control may be had. Use a very limited amount of fuel when testing under power so that model will not fly away or better still, use a timer.

Please bear in mind that a little patience exercised in testing your model will prevent many a crack-up.

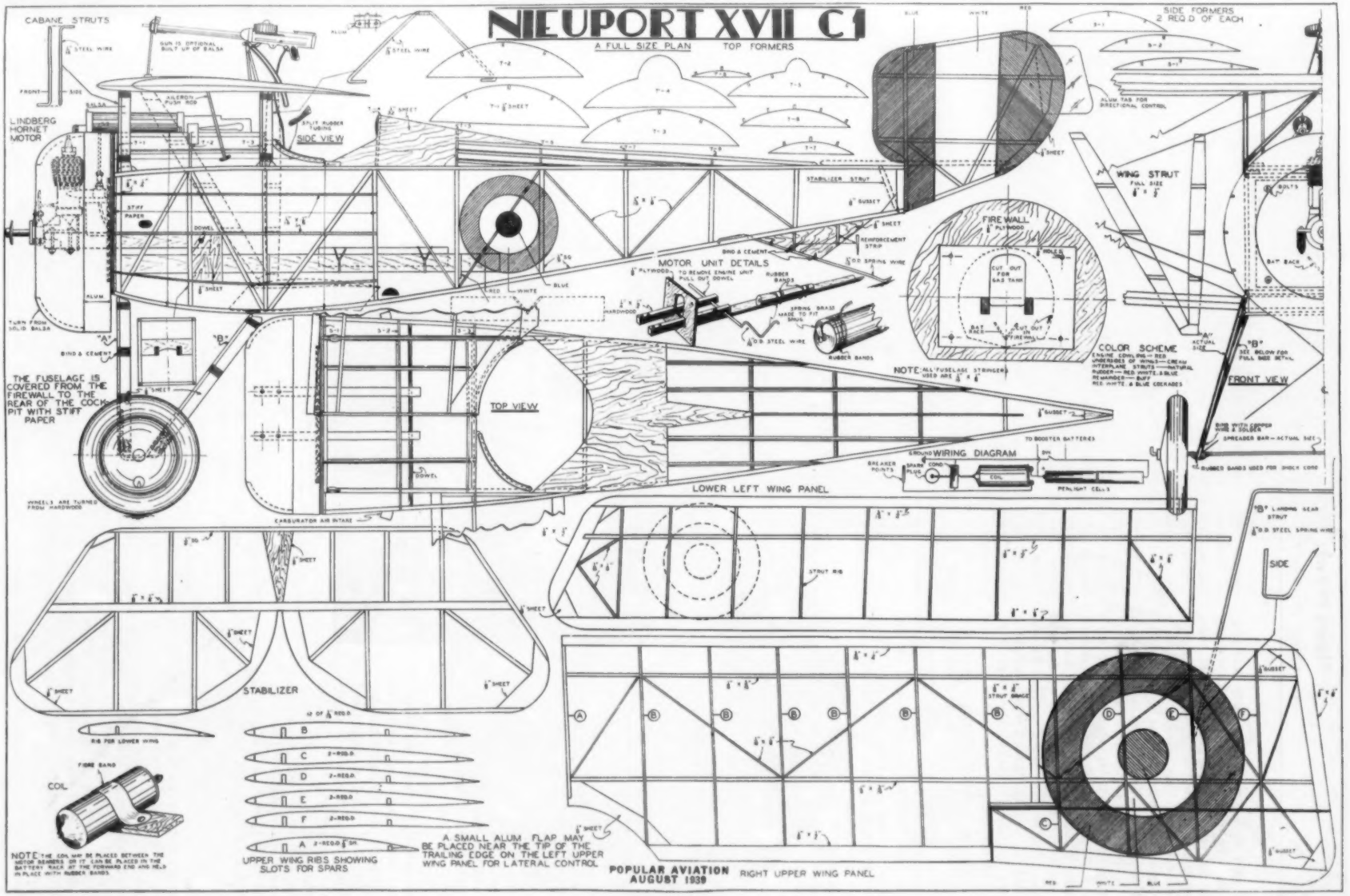


This model makes a pretty display piece as well as flyer. It is yellow with red trim.

Fire in the Air

THE inspectors of the Aero Insurance Underwriters have frequently examined airplanes with oil soaked fabric on the bottom of the fuselage. Such a fire hazard often goes unnoticed or is neglected by the owner or pilot, but it still is a real hazard just the same.

One fire, due to this oil soaked fabric, did occur recently. The pilot after noticing smoke in the cabin decided to land to determine the source of the smoke and, as he approached the ground, the smoke grew thicker and thicker. The mystery was solved, the moment he landed, for the flames became visible under the floor, blazing out from the oil soaked fabric which had probably become ignited from a grounded wire.


NIEUPORT XVII C1
A FULL SIZE PLAN
TOP FORMERS
SIDE FORMERS
2 REQ'D OF EACH
CABANE STRUTS
LINDBERG HORNET MOTOR
SIDE VIEW
TOP VIEW
FRONT VIEW
MOTOR UNIT DETAILS
FIRE WALL
WING STRUT
COLOR SCHEME
THE FUSELAGE IS COVERED FROM THE FIREWALL TO THE REAR OF THE COCKPIT WITH STIFF PAPER
WIRING DIAGRAM
LOWER LEFT WING PANEL
STABILIZER
RIB FOR LOWER WING
UPPER WING RIBS SHOWING SLOTS FOR SPARS
A SMALL ALUM FLAP MAY BE PLACED NEAR THE TIP OF THE TRAILING EDGE ON THE LEFT UPPER WING PANEL FOR LATERAL CONTROL
RIGHT UPPER WING PANEL
COIL
NOTE: THE COIL MAY BE PLACED BETWEEN THE MOTOR BEARERS OR IT CAN BE PLACED IN THE BATTERY RACK AT THE FORWARD END AND HELD IN PLACE WITH RUBBER BANDS.
POPULAR AVIATION
AUGUST 1939

News Hawks

(*Continued from page* 17)

the rain and fog of the early morning, on its way to get pictures of the tragedy that cost the lives of 160 or more men, women and children. Fighting a northeast gale, rain and fog, Duke Krantz flew through that haze to get his passenger, a photographer, to the scene of that disaster. For hours, Krantz flew around the blazing ship while his photographer took the first pictures of the ill-fated *Morro Castle*. Finally getting a sufficient number of shots to tell the real story of the fire, Krantz flew back to Sea Girt, New Jersey, landed his ship and gave the photographic plates to George Weiss who flew them back to the home airport and from which point they were rushed by messenger to the *Daily News* and the front page of the early morning edition.

The crack-up of the *Lady Peace* found these same two pilots on deck at the appointed time. Having been sent up to New England before Dick Merrill and Harry Richman reached Newfoundland, Weiss and Kranz were ready to go when word was received that the *Lady Peace* had been forced down in a bog somewhere. Flying a faster ship, Duke fell heir to the job of finding the disabled plane. After gathering bits of information at the airports in and around New Brunswick and Newfoundland, Duke finally went to Harbor Grace where he was told that the transatlantic flyers were down in a bog at Musgrave Harbor. Using an ancient map belonging to an old sea captain, and burning improvised high octane gasoline, Krantz and the photographer roared away to the north and finally to a smooth landing within a few hundred feet of the Vultee monoplane *Lady Peace*.

Getting there hours ahead of the rescue plane sent up by Captain Eddie Rickenbacker, head of Eastern Air Lines, the *Daily News* made the first exclusive pictures of the plane as she lay in the mud, wing tips smashed and propeller ripped off. Not only did they get pictures for the readers, but also the first interview and story that evidenced the very apparent discord between Pilot Dick Merrill and Harry Richman.

Not all assignments to flying adventure are in chase of disaster. Flying out over the sea to get pictures of a Navy cruiser or aircraft carrier is a not-out-of-the-ordinary job. With the World's Fair in New York now in full swing, the *Daily News* ships have been an almost daily sight to the many thousands below who are within the portals of this world of tomorrow. However, flying in places where no plane or pilot belongs is sometimes a part of the newspaper pilot's job.

Just recently, Krantz flew his Waco within 25 feet of the side of a mountain to get pictures of a youthful amateur mountain-climber who had dared the peaks of Breakneck Mountain and lost. Fighting the perilous downdrafts of the wind-swept canyon, Krantz flew close enough to allow his photographer a close-up view of the boy's body, entangled in his own safety line and dangling from the edge of the steep ledge.

Another shining example of the dish set before these airmen was the picture of the removal of Bruno Richard Hauptmann's body from the morgue of the prison at Trenton, New Jersey. While hundreds waited for hours outside the gates of the prison for a glimpse of the German carpenter's coffin, Krantz and a photographer literally flew circles above the tiny courtyard of the prison. For two hours, the *Daily News* ship circled above the throng, waiting for the tiny black speck that was the door of the morgue to open and for the coffin of Hauptmann to be brought out and placed in the hearse that would take it back to New York for burial.

". . . Why, Mister Abercrombie! . . ."

At last that moment arrived. The door opened and the end of the coffin appeared. Suddenly Krantz plummeted the plane down almost into the courtyard, the camera clicked and the *Daily News* gave its readers another "impossible" picture.

Last year, the hurricane that swept the Atlantic seaboard provided the pilots with another assignment. In this case, the storm that destroyed property valued in the millions, that crippled transportation, left cities and towns in isolation and darkness left the airplane as the only connection those within the storm area had with the outside world. Planes, both private and airline operated, flew supplies and materials day and night into the stricken sections. The *Daily News* planes were constantly on hand, taking pictures and bringing back eye-witnessed accounts of the destruction the storm had caused, and the reconstruction that was being immediately effected.

Other examples of picture-taking and reporting in which the airplane played a major role were the Tangier Island story in which 1,500 persons battled cold and hunger in the ice-bound Chesapeake Bay; the *Hindenburg* disaster at Lakehurst, New Jersey, and the recent U. S. submarine *Squalus* disaster at Portsmouth, New Hampshire.

In many cases where the covering of a particular story means the presence of a reporter and photographer at the scene for days at a time rather than just a few hours, the newspapermen or newspaperwomen are flown to the locale of the story by one of the planes. For the immediate transmission of pictures in such cases, a New York *Daily News* Associated Press portable Wirephoto apparatus is hooked up to the telephone outlet nearest the actual scene of the news and pictures are sent out on it directly to the newspaper office.

In addition to the regular staff pilots the *Daily News* on occasion employs relief pilots. Bill Grey, Sam Held, Buster Warner and others have flown *Daily News* ships. Buster Warner was at the controls of the Waco recently when the paper sought the first pictures of the Russian flyers whose transatlantic flight ended on Miscou Island. Warner and Photographer Charles Hoff took off from Floyd Bennett Field at three in the morning and navigated straight to Moncton, New Brunswick, where they stopped for customs inspection. Taking off again, the ship flew over snow-covered country to Miscou Island. Warned by a Very gun in the hands of one of the Russian airmen not to attempt a landing. Warner flew around the disabled plane, swooped down over it and did everything but land to allow Charles Hoff to get close-up pictures of the Moscow-to-New York flight which ended 700 miles short of its goal. Flying back to New York, Warner landed the *Daily News* ship at Holmes airport—just 14 hours and 10 minutes after they had taken off from Floyd Bennett Field—1,600 miles for the first pictures of that crack-up!

The right plane flown by the right pilot is the requirement of the newspaper today. With all its adventure the *Daily News* flying has been done in perfect safety. Pilots Krantz and Weiss say:

"The dangerous part of our job is the driving we do on the highways each day to get to the airport and home again. It's swell up there."

"Up there" is the airlane that brings stories and pictures to the readers of the New York *Daily News*.

END

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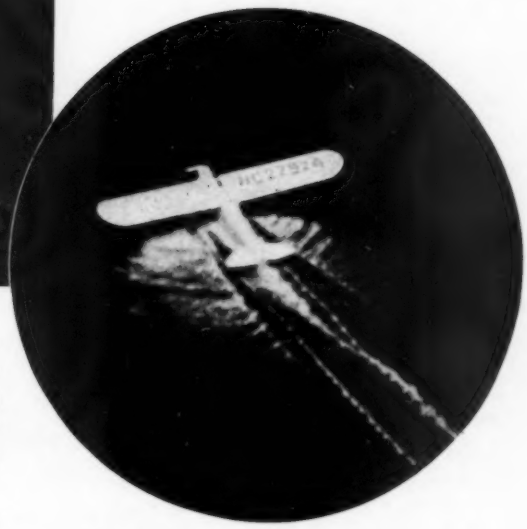

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Air Corps Birthday

(*Continued from page 31*)

and there continued operations by the trial and error method. After the errors, while the airplane was being repaired out of his own pocket, he communicated his woes and experiences to the Wright brothers and received their advice by return mail—the world's first correspondence course in flight instruction.

Seven years after the Army obtained its first airplane, Army aviation received its baptism of fire when, in 1916, the 1st Aero Squadron went into Mexico to operate with the punitive expedition commanded by Brig.-Gen. John J. Pershing. It was a hard proving ground for the new air service, operating far from base over difficult country, but it was excellent training for the ordeal of the World War into which the insignificant American aviation service was to be plunged in the following year.

When the World War swept the United States into its maelstrom, on April 6, 1917, the aviation section of the Signal Corps was composed of 35 pilots, 1,087 enlisted men and 55 training airplanes. The frenzied efforts of the following months to build up an American air service are history. Caught flat-footed, this country was just swinging into the mass production of airplanes, engines and pilots when the Armistice, 1918, began to pave the way for Nazi Germany and Hitler, who 20 years later were to use the mere threat of air power to conquer nations which probably would not have yielded to any other threat.

In 1918 the Air Service was formed from the aviation section of the Signal Corps and military aviation achieved its place as an independent service—fortunately, for the sake of the development which was to come during the ensuing years of peace. The year after the war was a period of reorganization, liquidation and consolidation. There were no achievements which, after this lapse of time, stand out as particularly noteworthy.

In 1920, however, the Air Service began to do things and to go places. On January 20 of that year a radio message was received from an airplane in flight over a distance of 175 miles. A little more than a month later Maj. R. W. Schroeder, in an Army pursuit plane, established a world altitude record of 33,000 feet. The Air Service was materially strengthened in its position as an independent branch of the Army in the Army reorganization bill enacted June 4. On November 24 Lieutenant C. C. Moseley capped a very successful Air Service year by winning the Pulitzer Trophy Race.

The year 1921 found the Army Air Service contributing largely to civil air progress. The first airway was opened between Washington and Dayton for military purposes; the experience was not without benefit to the Post Office Department which was beginning to expand the airmail service which, in 1918, it had taken over from the Air Service. In August, the Air Service successfully dusted poison by airplane to fight insect pests; from that time airplane crop dusting grew rapidly, especially in the cotton belt. The Air Service was called upon for forest patrol service. By September 1 it had completed 396 such flights in the Northwestern States.

During a period of less than a month in the latter part of 1922 the Army Air Service brought three world records to the United States. On October 6 Lieutenants Oakley G. Kelly and John A. Macready established a world endurance record of 35 hours, 18½ minutes. On October 18 Brig. Gen. William Mitchell

"... He thinks he's spying on us. Shall we report him to the commanding officer or just start the engine? ..."

was clocked at 224.38 m.p.h. over a measured kilometer to establish an international record for the distance. And, on November 4, Lieutenants Kelly and Macready set a new world distance record of 2,060 miles with a flight from San Diego, Calif., to Fort Benjamin Harrison, Ind.

By 1923 the Air Service was beginning to spread its wings outside the confines of the continental United States. On April 3 of that year six Army airplanes flew to San Juan, Puerto Rico, and returned. The flight, to some extent, was a preparation for the flight around the world during the following year; completed by two of four special Douglas airplanes which flew 27,553 miles in 175 days.

The marooned inhabitants of South Fox Island, Michigan, were relieved when Army airplanes dropped food and clothing in April, 1923. Since that time there has scarcely been a year in which similar relief work has not been performed by Army aircraft in various parts of the country and in neighboring countries.

Lieutenants Lowell H. Smith and John P. Richter, on August 27, 1923, completed a world's endurance record with refueling in flight of 37 hours, 15 minutes.

The first maneuvers of the whole Air Service were held in April, 1926, at Fairfield, Ohio. For these maneuvers the service was able to muster 45 officers, 67 enlisted men and 44 airplanes. This evidence of poverty probably was not without its effect. On July 2 of that year Congress authorized a five-year expansion program to increase the Air Service to 1,800 serviceable airplanes, 1,650 officers and 15,000 enlisted men and at the same time changed its designation from Air Service to the present Army Air Corps.

The Air Corps made its famous 20,000-mile good will flight around South America in 1927 and on June 29 of that year Lieutenants Lester G. Maitland and Albert F. Hegenberger completed the first flight from the United States to Hawaii.

Not only in heavier-than-air was the Army Air Corps achieving success. In June, 1928, the Air Corps team won the international balloon race and permanent possession of the Gordon Bennett Trophy.

A period of vitally important technical achievements was ushered in about 1929. In August of that year, Captain Albert W. Stevens made an aerial photograph of Mount Rainier from a distance of 227 miles, exceeding by 50 miles any previous distance recorded photographically on the earth's surface. On September 24 Lieutenant James H. Doolittle demonstrated a blind-flying take-off and landing. Development of instrumental technique continued and in May, 1932, Captain Hegenberger made the world's first solo flight entirely by instruments from take-off to landing. Continuation of this work since has resulted in the entirely automatic landing, without any intervention on the part of the pilot who merely goes along for the ride.

One of the most vital changes in organization since creation of the Air Corps itself came on December 27, 1934, when the Secretary of War approved the creation of the General Headquarters Air Force and Lieutenant-Colonel Frank M. Andrews was designated as its first commander. The G.H.Q. Air Force was officially organized on the following March 1 and since has become the spearhead of our whole air defense.

The importance of research continued to increase and the Air Corps, through its Material Division laboratories, in August, 1935, made the first flight using radio compass to control an automatic pilot, thus providing automatic radio navigation. Improvement of aircraft and engines was being carried forward. In August, 1937, there was completed the first pressure cabin airplane designed for

(*Continued on page 84*)

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The First $50,000,000

(*Continued from page* 12)

I suggested to General Arnold that the procedure be stopped and the notes destroyed. General Arnold tore up the stenographer's notes.

Today, as I write this article, Congress is debating an expenditure of $250,000,000 to be spent in the next two years to bring our air force up to the desired strength. The money will be used not only for planes, but for paying of personnel for construction of hangars and repair shops, for aerial bombs, for maintenance and for research. How much is to be allotted to each of the various phases of the program would be but a guess at the present writing.

Two hundred and fifty million dollars for the Air Corps sounds like a good sized sum and it is. If it succeeds in building us an air force that will adequately defend the Western Hemisphere against any form of aerial attack it will indeed be a very cheap price. When divided among our population of 140,000,000 people, it is in fact less than $2.00 per person. Is there any man, woman, or child in America who would not be glad to pay that amount for adequate air defense?

I wish, however, that the American people could be assured that the expenditure of $300,000,000 in a little more than two years would be all that we would ever need. I wish I could say that 6,000 planes will be enough to defend America adequately at all times but I would not dare. No one can foretell what the future may bring. What is adequate today may not be tomorrow. We in America have not the last word on the subject.

We are confident, however, that an armada of the size contemplated with skilled operators to fly them, trained combat crews to man them, experienced mechanics to maintain them, efficient equipment to protect them, ample bases to support them, experimental facilities to improve them, and men of outstanding leadership to command them, will provide America with adequate air defense today.

To young men who are air-minded, the expansion program of the Air Corps offers two special fields for study and training, first, as pilots, and, second, as mechanics. For the first time since the World War, we are opening primary flying training in civilian flying schools. These preliminary courses will last three months. Those who make the grade will be transferred to the Air Corps Training Center at Randolph Field, Texas, for basic training, and those who succeed here will get the final three months in advance training at Kelly Field, also in Texas.

The civilian flying schools selected by the War Department are the following: Spartan School of Aeronautics, Tulsa Municipal Airport, Tulsa, Oklahoma; Santa Maria School of Flying, Hancock Airport, Santa Maria, California; Dallas Aviation School and Air College, Love Field, Dallas, Texas; Ryan School of Aeronautics, Lindbergh Field, San Diego, California; Alabama Institute of Aeronautics, Inc., Municipal Airports, Tuscaloosa, Alabama; Grand Central Flying School, Grand Central Air Terminal, Glendale, California; Parks Air College, Parks Airport, East St. Louis, Illinois; Lincoln Airplane and Flying School, Union Air Terminal, Lincoln, Nebraska; and North Suburban Flying Corporation, Curtiss Airport, Glenview, Illinois.

All of these schools have met the rigid standards of the Civil Aeronautics Authority and the War Department. The instructors are men who hold a certificate of competency from the Civil Aeronautics Authority and each has completed a standard course at the Air Corps Training Center at Randolph Field.

Whether you go to school in Illinois, Alabama, Oklahoma or any other place where these facilities are located, you will get the same training. The planes will be the primary training planes furnished by your Government. The courses beginning July 1, 1939 and every six weeks thereafter will enroll as cadets, unmarried, male citizens of the United States between 20 and 27. The physical

(*Continued on page* 66)

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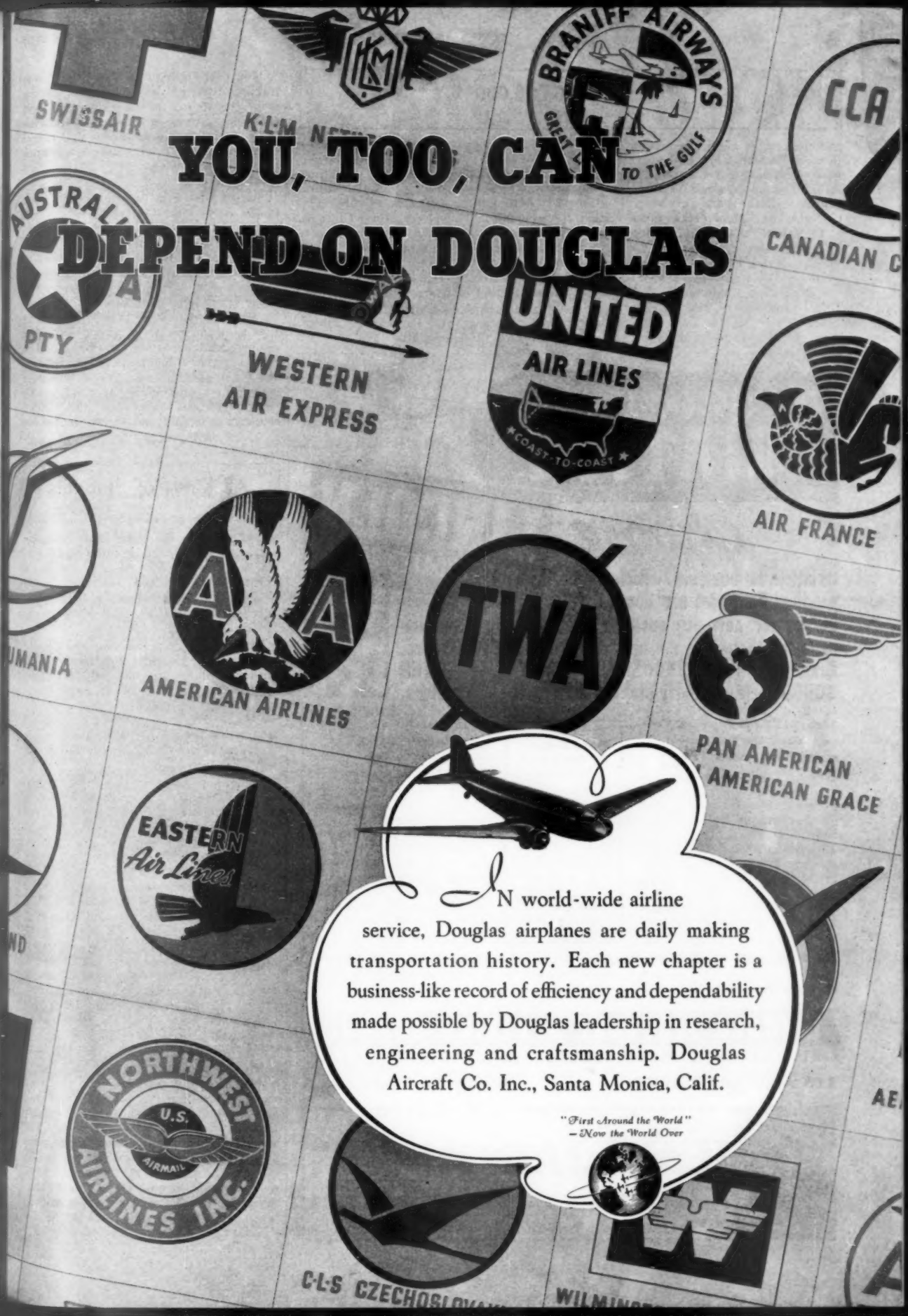
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The First $50,000,000

(*Continued from page 64*)

examination is rigid. Minimum education requirements are two years of college work or their equivalent. The pay is $75.00 a month and $1.00 a day for rations. Clothes are furnished by the Government. Other details are available at the schools mentioned.

The increase in planes has necessarily increased the demand for skilled mechanics. The Army has schools already established at Chanute Field, Rantoul, Illinois and Lowry Field, Denver, Colorado. These will not be able to take care of all the needs during the year July 1, 1939 to June 30, 1940, and the Army plans to send 1,000 of its enlisted men to the following schools for instruction: Curtiss-Wright Technical Institute of Aeronautics, Glendale, Calif.; The Aeronautical University, Inc., Chicago, Ill.; Roosevelt Field, Inc., Aviation School Division, Roosevelt Field No. 1, Mineola, L. I., N. Y.; Spartan School of Aeronautics, Tulsa, Okla.; Casey Jones School of Aeronautics, Inc., Newark, N. J.; New England Aircraft School, Boston, Mass.; and Parks Air College, Inc., East St. Louis, Ill.

The use of civilian schools for the training of Army Air Corps enlisted men is in the nature of an experiment. If the test proves satisfactory—and the War Department is confident that it will—then a very effective part of our work for national defense will have been achieved.

I trust that this description of some of the more important parts of our expansion program for our Air Corps will give our young men a better understanding of the role America intends to play in aviation. It is our hope that not a single pilot now in training or about to be trained in the future will have to fly a plane in combat. We firmly believe that a strong air force will deter other nations from violating our rights. But, if we are ever called upon to defend ourselves in the air, our hopes will rest largely upon the chivalrous knights who ride our aerial lanes and the skilled mechanics behind the flying machines.

END

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All Kinds of Students

(*Continued from page 23*)

lent air across the field. Not realizing what a serious condition the wind was causing, I took off. After fighting for altitude with the ship bouncing around in the swirling currents, I turned out over the river at an altitude of about 25 feet.

In order to keep the ship level I had to move the controls constantly. The stick was slapping around, in fact, quite as much as the ship. With downdrafts to fight I was having considerable difficulty in keeping out of the water. I completely forgot my instructions to the literal-minded Swedish gentleman in the rear seat.

When he saw the stick shaking violently, as per my description, he seized it. I felt him take hold. It was like hooking a whale on a trout line. I found myself flying the ship and the student, too. When he discovered he lacked strength to hold the stick steady with one hand he immediately pounced on it with both. Thereafter we staged a wrestling match which would have done credit to Man Mountain Dean and a couple of others thrown in for good measure. The ship rocked wildly, lost altitude and I saw that I wasn't strong enough to hang on. I thought fast, turned around, smiled a confidence that no operator feels as his ship is about to go into the drink with him in it, and shook my head from side to side.

That did the trick. The big blond Viking let go. I wrestled with the wind currents, swung the ship around and got back into the field more quickly than I believed was possible. The would-be student crawled sadly from the cockpit, shook his head despondently.

"Ay vas right!" he moaned. "First ay take stick in one hand. She vobble. Ay take two hands. She still vobble. Then you turn around, shake head—

(*Continued on page 70*)

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Arctic Freighters

(*Continued from page* 46)

Costly as it may seem to charter a plane—and the average fare in the far north runs into several hundred dollars—it is cheaper for the trappers and traders to ship their furs out by plane and to travel in to their trapping grounds again by plane, than to do it by the old-fashioned canoe or dog team method. Food for men and beasts for several weeks costs money, as do canoes, outboard motors and sleds. So the airplane is being used to take furs out more frequently, enable smaller profits to be made with a more rapid turnover. Planes visit fur posts even on the Arctic islands north of the mainland to pick up bales of fur and a load of $50,000 in fur is not uncommon.

The airplane now is considered part of the fur business. The crew of a three ton payload freighter was nearly marooned one winter on the shores of Hudson Bay. Part of a fleet of planes taking in supplies to fur posts, this ship was caught on its last trip. One of those sudden early winter storms of the north hit the post while the planes were riding at anchor in the bay. One of the planes came loose, rammed into the pontoons of the big ship and jammed into an ice floe. As planes carry spare pontoons the smaller ship was easily repaired.

Not so the big ship. Its pontoons had been made special. And it took the crew nearly a week in the biting winds of early winter to repair the pontoon sufficiently with the limited material at the post for it to float the plane during the take-off. Then it sprang a leak. The difficult job had to be done again, this time with less material. But though the weather jumped to below zero, and the bay was covered with ice before they were ready, the crew broke a channel through the ice and managed to take-off with the repaired pontoon for the 2000 mile hop to Winnipeg, its base.

One of the biggest freighting jobs on record in Canada was the transportation to a new mine of 800 tons of freight in four months. The airplane was called to put an entire new community on the map in 120 days. Four planes worked night and day, guided by short wave radio in northern Ontario, a region of bush and lake where there are no telegraph lines, no towns, no landing fields but innumerable small lakes. Fifty men went in by air to put the town and the mining camp together. They unloaded from the planes ton-weight ore buckets, sections of Diesel engines weighing as much, dozens of drums of fuel oil, insulating material, barrels of nails, steel rails, a portable sawmill, hundreds of bags of cement, office furniture, all manner of tools from diamond drills to hand hammers, groceries for hungry men, dynamite and nitroglycerine in quantities to blow tunnels far underground at this new mining camp. They finished the job on the dot. The mine has been using the airplane ever since to bring in all kinds of supplies.

Airplanes have made commercial fishing of the northern regions of Canada a practical and profitable business. Today hundreds of lakes, large and small, are being used for winter fishing grounds, netting the finest-flavored fish, with whitefish, pickerel, trout and tullibee the principal species. Winnipeg goldeyes and similar smoked fish come from these northern waters.

Millions of fish are caught each winter on the prairie provinces where commercial fishing has taken a big hold with the discovery a few years ago that the large inland lakes abound in fish of commercial value. Winter is fishing time in these lakes in Manitoba, Saskatchewan and Alberta and the southern part of the North West Territories. Through holes in the ice the fishermen haul in their huge nets filled with fish. They are boxed or put in sacks at the fishing camps, and planes call at regular intervals to fly the fresh fish south.

Flying the fish freighters is also not the simplest of jobs in winter time. The northern pilots have to do more than just fly their planes. When it is good and cold in Canada's northland the pilot and his engineer—if he is lucky enough to carry one—have to clean ice off the wings of their plane when they park the ship on the ice in the evening. They have to drain all the oil from the crankcase and keep it warm in a log cabin (if they are lucky) or else in a canvas nose hangar using a portable oil stove. Then the engine is covered with a big tarpaulin, shielding it from the wind. In the morning, before dawn, that tarpaulin serves also as a windbreaker when plumber's blowtorches are used to warm up the engine for two or three hours. When the engine is considered warm enough the oil is replaced and the engine started.

Meanwhile the engineer and probably somebody from the fishing camp have again cleared the wings of any ice formed during the night. They do this by pulling a rope carefully over the wing surfaces, back and forth till the ice is off. After all these preparations the ship is ready to take off as early as possible to take advantage of the few hours of flying visibility in the short sub-Arctic days.

Sky freighters have meant to Canada's growing northern population the difference between isolation and living in modern style. Northern miners, for instance, living 1,000 miles north of the nearest railway do not have to subsist on canned foods at Christmas time. Last winter the men and women of the booming mining town of Yellowknife on Great Slave Lake had their regular Christmas dinner. Five thousand fat turkeys with all the trimmings, including cranberry sauce, were flown from Edmonton, Alberta, nearest city. It cost $8.55 for the average 15 pound turkey with all extras and air express charges to Yellowknife—but the miners had their Christmas dinners.

Similarly sporting equipment, cameras, the latest magazines and newspapers go regularly by air to relieve the isolation of the northerners. Live air freight in the form of hockey players from different mines fly the northland's skyways. Instead of a land open only three months of the year, the northland is now open eight months of the year. A short period each spring and each autumn when ice breaks up or forms, makes flying impossible.

(*Continued on page* 70)

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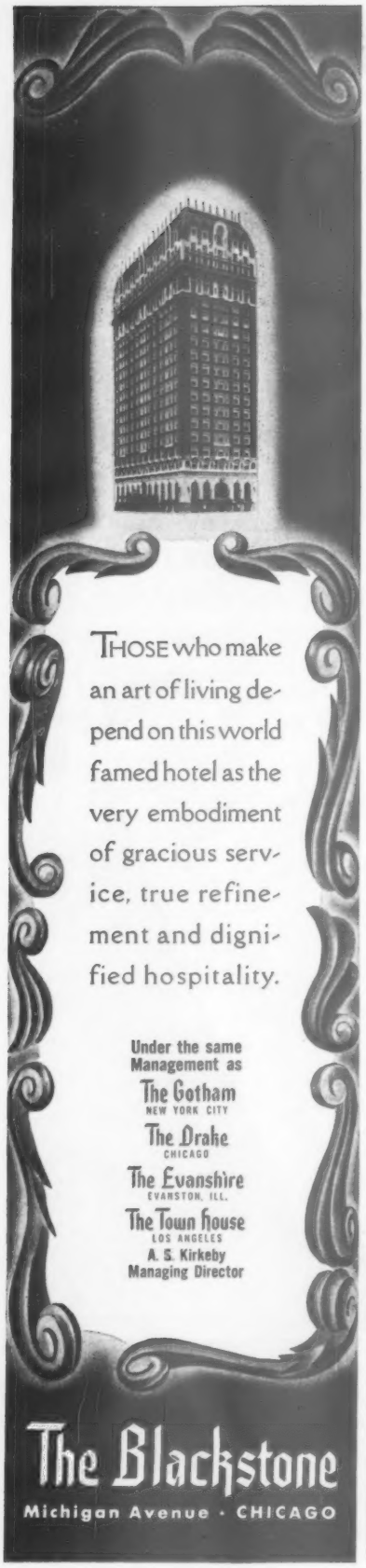
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Arctic Freighters

(*Continued from page 68*)

Ingenuity is called for in the placing of much of the air freight. There was, for instance, the ton-weight end of a ball mill which had to be flown into a mine as an emergency before the ice break, otherwise the mine would have had to cut its mill capacity in half till water transport was available a month later.

The ton-weight baggage was a circular disc, six feet in diameter and about six inches thick with a large bearing on one side at the center about 24 inches long. The pilot and his assistants maneuvered the disc through the wide doorway, tilted it at an angle to allow it to slide in the cabin. A cradle was then built under the unit to carry it at that angle. Then two bearings each weighing 300 pounds were cradled alongside the disc. The pilot took off on the ice with skis. In 75 minutes he had delivered the freight at the mine. What if the disc had started to slip as he took off, or had slid forward as he landed!

Then there was the pilot who had to take two live cows to a mining camp. They were strapped into the cabin with heavy ropes. There would be no chances of those heavy animals coming loose and wandering about the ship as it sped with them to the mine. The cows arrived in good shape—but the pilot of that sky freighter was glad it was not an everyday occurrence.

END

All Kinds of Students

(*Continued from page 66*)

and ay know ay am not strong enough."

Carefully, I explained to him what had happened. I told him to come back when the wind died down and he'd see that I was right. He did. Eventually, I taught him to fly.

These are stories of two students. Add 2,998 to them, and you realize how many individual problems there are. If you are flying, you are one of thousands but at the same time you are an identity separate from all the others and the instructor must understand your own particular quirks before he can solo you. No matter what you do, from downwind take-offs to sticking your arm out to make a left turn, don't feel that you can't make it. No matter what you do, rest assured that somebody has beat you to it. Go to the field tomorrow and quit worrying about the "boner" you pulled today—providing you've learned the lesson it taught.

One of the most frequent questions asked me as I tour the country these days giving aerobatic exhibitions is:

"Can I learn to fly?"

Often, with the question goes a long recital of complexes, imagined mental quirks and exaggerated physical infirmities. My answer is usually in the affirmative and is based on experience, as you will see by the following statements.

Less than one per cent of those who have come to me for instruction—I would say approximately 25 persons in all—have been forced to give up their flight instruction without having soloed because of physical or mental disabilities. And, of those, 25, most were disqualified because they lacked the most important qualification for landing—depth perception. Depth perception is the ability to correctly judge the distances of objects from the eyes. Today, student pilots are tested by physicians. The student is asked to line up two small vertical rods about 20 feet from him so that each is the same distance from his eyes. A variation is allowed. If the student's variation is too great he is disqualified before he has wasted time and money in attempting to learn to fly.

Another question which is constantly cropping up is the length of time one should take to solo. As I have pointed out, each student is different than the other and this question is difficult to answer. The Civil Aeronautics Authority, which denies a pilot's license to those without depth perception, wisely rules that no student shall be soloed in less than eight hours. I have known students who literally have taught themselves. I know that a student 13 years ago soloed in an hour and a half. He wasn't turned loose because he knew how to fly but simply because two rival instructors were having a race to see who could solo students with the least amount of dual. On the other hand, I know a test pilot rated as one of the best flyers in the country who required 54 hours of dual to solo. Top, in my actual experience, was a 65-year-old physician. He soloed after 25 hours. The main difficulty was poor sight.

One type of student is terribly anxious to learn to fly. He is usually slower than the phlegmatic type, who takes things in stride. I've tried to analyze this urge to solo and its effects. It seems to me that he is slow mainly because he is afraid that if he doesn't solo in eight hours something is wrong with him, that he is inferior to his fellow-students. Nothing could be farther from the truth. One of the best men I ever trained was one of the slow learners. Today he is an instructor in the northwest and has been teaching others to fly for many years. I consider him one of the country's outstanding teachers. He came to me in 1920, taking his instruction in an OX-5 Jenny. In those days, to point out possibly the origination of today's worry about soloing in eight hours, the student who didn't get off the ground alone in six or seven hours was considered a "problem child" by many teachers.

I don't remember exactly how much time I gave the fellow, but I think it was much closer to 20 hours than it was to seven. After he had finally soloed he dropped flying until the following spring and had to come back for further dual instruction before he could be turned loose again.

Like many students, he was too stiff on the controls. He couldn't relax. I saw what was the matter and took him up for stunt rides whenever I got a

(*Continued on page 74*)

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HOME OF THE DAWN PATROL

What's Up There?

(*Continued from page* 20)

the troposphere below. As yet there is no way of accurately forecasting these winds and absolutely nothing is known about wind conditions over any period at these levels. All data resulting for high altitude sounding balloons runs observed by theodolite or the drift of stratosphere balloons lose significance when it is realized that such data perforce had to be taken during general pressure distributions and atmospheric conditions ideal for light winds. The knowledge of wind conditions vital to aircraft operation at the base of the stratophere is when storm conditions at low levels make sounding balloon runs impossible. Perfection of the radio meteorograph and extensive data from actual flights over many storm conditions must be had before any comprehensive knowledge will be available of winds on top of storm areas.

The last flight from Kansas City proved by far to be the most interesting and significant. It was planned to fly the *Gamma* to New York. The flight was to be non-stop and over weather, if suitable conditions prevailed.

The day the flight was made, all transport aircraft were grounded bettween Kansas City and New York. An over-running warm front was producing low ceilings, occasional snow, moderate rain, mist and fog and icing conditions across the 1,100 miles of airway. However, the meteorologists predicted that the noon conditions at New York would be 1,000 foot ceiling with one to two miles visibility, which would be ample for landing.

On previous flights no continuous overcast had been observed to reach above 31,000 feet. The *Gamma* could cruise comfortably up to 34,000 feet. Two hundred miles east of Kansas City, the *Gamma* was flying "on instruments" at 34,000 feet with radio beam reception becoming poor on account of static. As before, this high cloud had the appearance of extremely heavy haze. Within the next 50 miles the radio beam reception dwindled to almost nothing and short wave two-way communication became difficult. The temperature was steady at —40° F.

Descent was made to 20,000 feet in hopes of getting between cloud layers, where radio beams might be heard, but the cloud was solid, with static everywhere the same. Approximately 450 miles east of Kansas City, the *Gamma* was back at 34,000 feet still flying "on instruments" with all radio reception obliterated by static. Navigation then became pure dead reckoning, under most difficult conditions. Constant attention had to be paid the gyro instruments in order to maintain a straight course. The aileron, elevator and rubber control was sloppy, due to the airplane being near its ceiling.

When about 300 miles west of New York the course was changed to northeast and the *Gamma* climbed to absolute ceiling, in a desperate effort to top the clouds in order to regain radio reception. Finally an altitude of 36,000 feet was reached. Short glimpses of blue sky and the sun's disc indicated that the plane was nearer the top than at any time before during the flight. The temperature, which had grown colder throughout the flight east and the last climb, was down to —75° F. This altitude was held for about 20 minutes, during which two-way communication with the Newark ground station became possible though unsatisfactory and radio beam stations could be heard during lulls in the static.

By this time—four hours after departure from Kansas City—the plane should have been in the vicinity of New York. Due to oxygen deprivation, the writer was in poor mental condition. An attempt to use the Newark radio range station to approach New York resulted in mistaking the south quadrant N signal for the north quadrant N. This was caused by the fact that, during descents from high altitude, the increase in pressure and recovery from oxygen starvation, caused the intensity of radio signals to seemingly increase. In this case, although the writer was actually heading away from the radio station the intensity of the signal seemed to be increasing, which gave the impression of traveling toward the station.

Ultimately the writer discovered the error, when about 150 miles out over the Atlantic Ocean at an altitude of 5,000 feet. Just enough gas remained for the plane to arrive over Princeton, N. J., about 20 miles inland, when the fuel supply failed. With a 300 ft. ceiling, one-half mile visibility and a freezing rain, a safe, forced landing was made on the side of a hill.

The height of the clouds encountered on this flight altered opinions previously held in respect to the height to which clouds reach, also the depth of warm front cirrus clouds extending over a great area. Actually, the fact that the plane was flown through clouds had no bearing on the termination of the flight. The static was primarily responsible for navigational errors. No turbulence worthy of mention was noted above 20,000 feet and no ice other than a frost on the entering edge of the wings and windshield. All that is necessary for safe operation through high level clouds is an anti-static antenna. In this connection it is believed that the present anti-static shielded loop antenna will be satisfactory.

We might then expect to see, as a result of the tests we have made, an early raising of the level of transport cruising to 20,000 feet before the end of the year. Some day, perhaps, we will be flying higher, but for the present 20,000 feet appears to be the limit. When stratosphere flying comes, it will be with equipment far different from that now in use.

END

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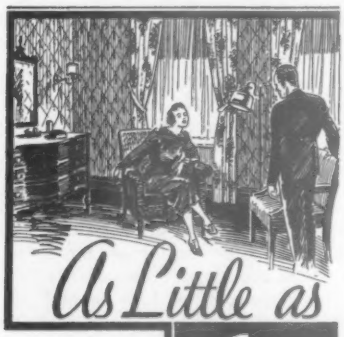

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Canada's Airline

(*Continued from page 40*)

cially in the development, by Imperial Airways, of trans-Atlantic service from Southampton, England, to Montreal and New York, and expects regular schedules to be in operation ere the summer is over.

Later will come the final link in a round-the-world Empire route—that between Vancouver and Australia. Plans for a branch line from Toronto to Buffalo are on hand, while other services are to be developed as the traffic warrants. Incidentally, it is interesting that Toronto is the only one of the four large Canadian cities which has not been directly in connection with United States cities. Seattle-Vancouver, St. Paul-Winnipeg and Albany-Montreal services have been in operation for years.

TCA equipment includes nine Lockheed 14-H's and five *Electras*. Each ship carries 10 passengers, steward and two pilots, while the 14-H also flies 2,800 pounds of mail and express.

The company, capitalized at $5,000,000—all issued of which are owned by Canadian National Railways—operated at a loss of $100,000 plus, in 1937, the first year of operations. In 1938, the first full year, its loss was $800,000 plus. Officials are, however, optimistic that given another two to three years at the outside, they will be in the black. Whether anything government-owned can be operated at a profit has, of course, as yet to be proved in Canada. The response to the airline service has been good so far and will continually improve. But full pay-loads every trip might still not be sufficient revenue if political interference is allowed to burden the line too heavily with unnecessary overhead expenses.

One outstanding feature of the TCA route is its mountain division. Only about 480 miles of flying is necessary to cross the mountains, or approximately one-half the distance of the United States division. Furthermore, there are no emergency landing fields higher than 4,000 feet, compared to United States' 8,000. Flying at 11,000 feet, the aircraft has a clearance of 2,500 feet over the highest peaks within 30 miles on either side of the route. Emergency ports are located every 100 miles, as are the radio range-finding stations.

Time from Montreal to Vancouver is 14 hours, 50 minutes, or approximately 35 minutes faster than the new United Air Lines schedule from New York to San Francisco.

In the inaugural flight, a fully-loaded machine of passengers, of which the writer was one, jumped from dirty struggling-for-spring Toronto to the bright six feet of snow at Kapuskasing, in Northern Ontario; to the brisk bright early spring days of the prairies west of Winnipeg; and, finally, to the mid-summer-like temperatures at Vancouver—all in a period of less than 15 hours.

There were only four intermediate stops; Kapuskasing, where 3,000 people live to operate a paper mill in the deep backwoods of Northern Canada so as to supply the newsprint needs of the New York *Times;* Winnipeg, whose 315,000 residents boast being the wheat capital of the world; Regina, a farm city of 70,000 souls, which used to proudly call itself the Queen City of the West, but which is now not so proud to be the Gateway to Canada's dry belt; Lethbridge, a sleepy town of 12,000 people serving a ranching district; while the final stop at Vancouver brought us to 325,000 of the most cosmopolitan population in Canada.

It can be said, without using a patronizing tone, that—due primarily to American equipment and executives—the efficiency and service of Trans-Canada compare with the best anywhere. Personally, I have only one complaint: they could improve on the tobacco in the cigarettes which are supplied aboard!

END

All Kinds of Students

(*Continued from page 70*)

chance, feeling that he would become accustomed to violent maneuvers and that normal ones in the course of time would seem easy to him. This proved to be the answer.

Mental hazards are far more difficult to overcome than physical deformities or lack of physical equipment. For example, I knew a pilot in California several years ago who mastered the flying business in spite of the fact that he had suffered the loss of one hand above the wrist and practically all of the other arm. Another example was one of my students who, I noticed, walked with a slight limp. He soloed after normal dual instruction and it wasn't until many months later that he confided to me that he had an artificial limb.

I also instructed and soloed another student who is now flying in Alaska. He was handicapped, as they say, by the loss of one eye—but it wasn't any handicap at all. Another pilot, whom I did not instruct, soloed and became an expert in spite of the fact that he had lost his right arm at the elbow. He handled the stick with his left hand and used a hook on his right arm to control the throttle.

During the course of my work I have instructed about 40 women. I have found that many women require about 50 per cent more dual instruction before solo than does the average man. I believe this is cased principally by the woman's lack of mechanical knowledge. Men are taught mechanics from the time they are old enough to hold a wrench and a pair of pliers. As a result they experience little, if any, difficulty in ground school subjects. These, to the average woman, are indeed difficult. If a woman has a conception of the mechanical side of aviation, has good depth perception and is healthy, I see no reason why she shouldn't become as good a pilot as any man. Jackie Cochran and many other courageous American women have proved definitely that women do make exceptional pilots. It is regrettable that today, in the United States, there is but one woman pilot to approximately 40 men pilots.

END

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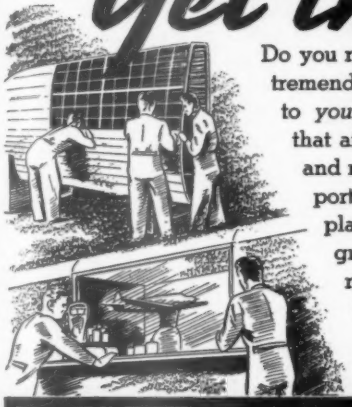

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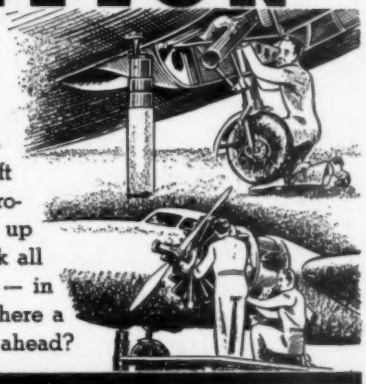

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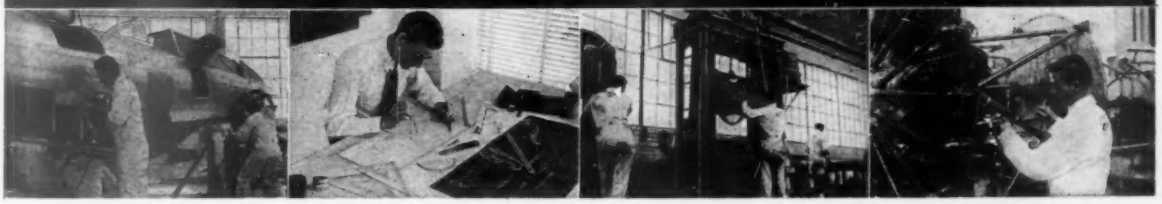

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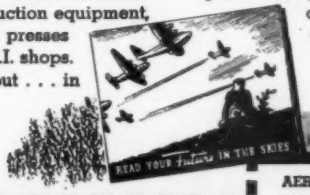

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I Learned About Flying. . .

(*Continued from page 21*)

refined and there had been minor structural changes. The design of the tail assembly had been altered.

"Okay," said Red.

We piled in, and a moment later were picking up speed down the field. Red was at the controls, which were single. The newspaperman and I were behind him. The day was perfect. The air was smooth, the sky clear and it was one of those days when you hate to have your feet on the ground. The plane got off well, climbed fast. Red, who wasn't planning on going any place in particular, stuck around the field, contenting himself with a steady climb until we got to four thousand feet.

"I haven't done much with her," he said, "so I don't want to try anything funny. But I'll show you her speed. She's got plenty."

He pushed the throttle to full advance. As the motor picked up the ship flew perfectly up to a certain point. At this point, trouble started so fast I lost the feeling of realiy for a moment. The tail began a deadly flutter. The flutter spread over the whole ship. The wings, in a shorter time than it takes me to tell it, began to vibrate so viciously that the ship seemed to be bouncing through the air. Instantly, I realized that we were in an extremely dangerous spot.

"This is it," I told myself. No, none of us wore parachutes. We were too sure of our ship. And now it was so badly hit by flutter that it couldn't hold together for more than a few seconds. That's where Red comes in. I never have seen a man recognize symptoms, diagnose them and go into action faster than he did. I never have seen a man as cool, as calm, as sure of what he was doing in an emergency—in that split second when a man, if he lives, earns the right to be called "a good pilot." He pulled back the throttle knowing that this was one remedy for the fluttering condition. The stick was slapping around. He got both hands around it and locked his body against it to help kill the flutter. At the same time, he pulled back to get the nose up and kill his speed.

He killed the flutter. It went out of the ship, but we all knew from the soggy feeling it had that it was still doomed if subjected to the slightest strain. Red again did the right thing. He kept his nose up, mushed toward the field, which, luckily, was still within gliding distance. He didn't touch the throttle again. We all knew that if he did there wouldn't be any ship.

He got us in to a smooth landing.

Then we went over the ship. Immediately we found out what had started the trouble. It was the cantilever fin. It was obvious that it needed bracing. And it was also obvious, to use a formal description, that "the structure was close to the failing point." I found the tail surfaces were just hanging together.

Of course, the tail assembly was rebuilt. The airplane was a particularly successful model. It passed its tests with an excellent margin of safety. I want to point out very carefully that the ship carried an "X", that it was not licensed and that it was not a finished airplane at the time I flew in it. The fault lay not with the airplane, but entirely with myself. I was like too many idly curious people who, before that incident and too often since, have "just been going along for the ride."

That experience—and I was actually closer to death that day than I ever have been before or since, even including one widely publicized accident—has made its mark on me. Today, I am testing the DC-4. You may rest assured that never at any time is there anyone in that plane while I am at the controls who is not there in line of duty. When any tests are being run, minimum flight crew—a total of five—is aloft. A test pilot's job is to find out, whether he's the young boy who has just completed his home-made plane or whether he is flying the newest and biggest ship of the finest factory, if his ship will take it. Until it does, it isn't a finished product. There is one rule you, as a flyer or passenger, can paste in your hat. Keep it there, and you'll never get yourself into the spot I was in that sunny afternoon over Lambert:

"You can expect anything from an airplane until you've proved it won't do it."

The Civil Aeronautics Authority is trying to protect you. It puts an "X" on a ship, which says for you and for everyone else to read, "This ship may be dangerous. We don't know, so we aren't telling you it's safe, until we find out."

The "C" tells you that if the ship has been properly maintained since its last inspection, and if the pilot doesn't attempt to exceed certain posted limits, that it is structurally safe. The C.A.A. has set up a definite system of identification so that anyone can recognize the status of any airplane at a glance. The "N" is the international marking for the United States. An "NR" ship bears a restricted license, usually meaning that no passengers should be carried. From the standpoint of the average person, the "X" ship should be avoided at all times.

As I read over these last few paragraphs I sound like old Uncle Benny telling the young whippersnappers how to do it. And I have a faint recollection of having heard somebody else saying the same thing a couple of million times. But, in spite of all the talk, people are still going for haphazard rides in "X"-marked ships which end vertically. Furthermore, there are few, like myself, who are, through sheer luck, able to speak from experience.

I am flying an "X" these days—but it's my job, and I'm not going along just for the ride. Before any flight in any man's airplane, Howard these days looks to see what letters are on the tail surfaces and hopes you'll do the same.

P. S.—Howard has also learned to wear a parachute.

END

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Novel Lady

(*Continued from page 42*)

women on that boat, on this or any other trip," protested the official in much the same tones as the Secretary of Commerce had used several years before.

"But that's just why I want to join the crew," said Miss Johnson patiently. And then, with her usual command of air facts, and her flair for promotion, she persuaded the backers that her presence on the boat on that first flight would be of inestimable help in launching the venture. Before she left Europe, she had won official permission to join the crew in New York.

But that was the summer of 1929 and when the Wall Street crash came, the dream of freight service by flying boat across the Atlantic faded—but not Mildred. She went to work immediately to introduce new angles in passenger flying for Eastern Air Transport, predecessor of Eastern Air Lines.

By January, 1931, Miss Johnson had inaugurated the air hostess system which Eastern Air Lines employed at first only on its Washington-New York planes. Five young girls, in a costume of flight gray and red designed by Mildred Johnson, were in the first group which flew from New York to Washington three times daily in training to become hostesses of the air. The public liked them and air travel boomed for Eastern Transport. The air hostesses had many duties similar to those of present stewardesses, but their principal business was to see that each passenger's trip was made as enjoyable as possible. They had to be qualified bridge players; they knew how to brew a cup of tea or coffee, the remedies for air-sickness and how to carry on a conversation on practically any topic.

To stimulate interest among women in air travel, Miss Johnson organized airplane theatre parties taking debutantes from Baltimore and Washington to the theatre in New York. Then there were personal air-shopping tours which began with an early morning plane breakfast just after leaving the home city and ended with tea (and bridge!) on the return afternoon flight.

But all these years Mildred Johnson had been working for other people. Then, along about 1935, bang! she went to work for herself. She was the first girl to start her own service bureau for travelers by air. As part of her program she organized what she called trade flights for business men. One such trip extended from Chicago to the chief cities of South America. Showrooms where goods could be displayed were arranged for in various ports and every opportunity was provided to make the trip of practical value.

Then she branched into air-shopping a couple of years ago, importing Hawaiian leis, Bermuda lilies, Colombian coffee, Mexican limes—anything exotic and unusual.

"I had seen passenger seats on European planes piled high with packages of expensive foods and out-of-season flowers," she said, "and knew they were being shipped by air to preserve their freshness, so I just started the same thing in America."

It wasn't quite so simple as that, although the quiet competence of this gentle-mannered woman makes you believe that even a three-ring shopping service is something to take as a matter-of-course. Her air-logs, chronicling the hours of the flight, the starting point and the end of the trip, together with especially designed packaging full of the glamour of far-away places, were described in pamphlets listing merchandise from all parts of the world. Orders began to pour in from travelers and stay-at-homes alike.

Soon manufacturers began to consult Miss Johnson about what travelers should wear for air trips, and designers still are following her counsel in making practical gadgets for air travelers or land costumes of aeronautical inspiration.

Urbane New Yorkers considered that she had arrived when the fashionable Stork Club listed on its menus the special crabs from Florida she had flown for them daily as "Bimini stone crabs Mildred Johnson." In a sense, that bit of sophisticated approval was the climax of years spent in proving that a woman with a new air idea can always find some place to sell it—if she has the experience to back it up.

Her latest "first" is a women's trade flight which this spring made a complete circuit of every South American capitol, with trunks of clothes, two live models, and a commentator to tell (and sell) the South American woman what to wear at each of the two World's Fairs.

That's all there is to the story—so far—except that she loves good food, can cook to perfection, is not married and, despite her record of at least one new aviation idea a year, has never let herself get so busy that she has to eat at her desk.

END

Jungle Airport

(*Continued from page 54*)

running parallel on both sides of the field, is the average dimensions of the jungle airport. To one side are the *bodegas,* buildings, workers' camp, TACA office and radio station and the chicle company's warehouses, all bamboo walled and palm thatched roofs.

But the jungle airfield engineer cannot stay to see and enjoy these modern improvements. Other fields are under consideration or projected, in areas farther removed. Tough *chicleros* must be consulted, the jungle must be flown over and minutely examined, air routes measured and climatic conditions studied. Presently there will be new lists of supplies to make out, equipment to be gone over, mules and mule whackers hired and laborers and camp staff enlisted. And the moment the rainy season is over the long, weary trek into another strange section of the jungle will start.

But Joe says there is always one advantage in a job like his: city traffic noises never bother him.

END

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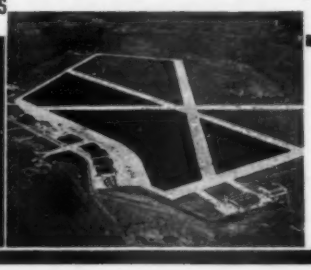

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Metal Fuselage

(*Continued from page 47*)

and they do save weight. The skin in this case would be either in small sheet sizes unformed, or large sheet sizes preformed. Bulkheads are generally manufactured in several segments and joined together by riveted splice plates. This does not seriously reduce the efficiency of the structure. A bulkhead of channel shape is very difficult to form or to roll due to stretching and compressing of the metal in each side, and the requirements of elaborate forming equipment.

The fuselage used in this investigation was that of a semi-monocoque design by William B. Stout, designer of the famous tri-motored Ford. The airplane was a high wing, full cantilever, two place, side-by-side cabin monoplane of all-metal construction. The fuselage was elliptical in cross section with four longitudinal channel stringers running full length at each end of the major and minor axes of the ellipse. The whole was covered with a smooth metal skin 0.032 inches in thickness.

The fuselage was turned over on its back to facilitate the application of the load on the tail post to represent the tail load of the airplane. It was held rigidly at the points of the wing attachment, so that the applied load created a bending moment about these points. A sketch of the set-up is shown in Figure 2. Six-inch steel scales were attached at each bulkhead point from the rear wing fitting to the tail as shown in the drawing. The load was applied on the tail post by means of a screw jack, and the load was measured by having the jack set on a platform scale. Two Huggenberger strain gauges fastened to the skin on the bottom of the fuselage gave an average value of the skin stress at the various loads. The scales on the side of the fuselage were all read by means of a surveyor's transit. Load values of 200, 400, 600, 800 and 900 pounds were applied to the fuselage.

The data for the actual deflections of the fuselage as taken from the transit are shown in Figure 3 for the various loads. The curves show a uniform increase in the deflections from the point of support out to the end of the fuselage, which is as would be expected. Also, a uniform increase is shown for a uniform increase in the load, which is likewise according to theory.

The variation of the skin stress with load data is shown in Figure 4. This is the data as recorded from the Huggenberger gauges, and the one curve represents the average values of both the gauges. There is a fairly uniform increase in the skin deflection from a load of zero to 800 pounds, after which the skin stress increases very rapidly. This is in general according to theory.

Shear and bending moment curves can very easily be drawn for any one of the loading conditions. The fuselage can be considered as a cantilever beam supported at two points in the drawing of these curves. The maximum moment occurs at the rear wing fittings and for a load of 600 pounds this moment is equal to 7,150 ft. lbs.

The first minor wrinkles were noticed in the skin at a load of 800 pounds and occured in the bottom and side of the fuselage about 30 inches aft of the rear wing fittings. The load was further increased to 900 pounds and the wrinkles became quite severe. However, as soon as the load was removed, the wrinkles in the skin completely disappeared; this was proof that the elastic limit of the material had not been reached. In no case was a load large enough to cause permanent failure applied to the fuselage, since it was not desired to permanently injure the structure. The load at which the skin of this fuselage buckled was very small compared to the maximum allowable load.

Several general conclusions may be drawn from observations made during the progress of this experiment. It is quite evident that the spacing of the frames would govern the buckling stress, the closer together they are placed the higher would be the wrinkling stress. The same ultimate effect could be obtained by using stiffeners to join the bulkheads.

It is true that the data presented herewith concerns only one fuselage, but this is a representative type of construction, and a careful study of the results will enable fairly accurate general conclusions to be drawn. The amount of deflection in any fuselage of a similar character could be safely predicted, and the general distribution of the stresses and deflections is quite evident from a study of the curves here shown. However, much more experimental work is necessary before predictions can be made as to the probable behavior of all-metal structures under various loading conditions. Until such time as the science has progressed to such a point of perfection, the industry will have to be content with the uncertain mathematical calculations and expensive full-scale experimentations which are the rule of metal construction today.

END

Locate Thrust Line

(*Continued from page 56*)

the advancements made is the influence of the change in flying weight. The weight center changes with or without passengers at the end with the tanks empty. By placing the removable weights in a position where they will balance the plane without resorting to a stabilizer adjustment. This is indicated in Section 15.

Most of these investigations are subject to the effect of the slip stream of the propeller on the stabilizer and to the change in moment by the weight of the elevator if control-free conditions are investigated. Nevertheless a lot of advancements have been made in the last years toward an airplane that will be the choice of the future air enthusiasts.

END

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SEPTEMBER ISSUE ON SALE AUGUST 10

Airy Chat

(*Continued from page 8*)

had to ride a sleeper train to Washington because the airlines were sold out. It was our first ride in a Pullman berth and, in all fairness, we much prefer the sleeper planes. Got to Washington next morning just in time to catch the morning plane for Cincinnati. There Carl Wootten, Aeronca vice-president, was waiting with a new 65 h.p. Aeronca and we were off for Louisville, Nashville and Birmingham. Two days in Birmingham at Steadham Acker's mushrooming free air carnival gave us our first and exciting taste of southern hospitality. Then out to Birmingham's sultry airport in the heat of the night to catch the plane to Atlanta in time to connect with the plane for Chicago. Flew and slept all night. At Chicago airport in time to get to the office at 8:45. Mileage in four days: 2,551. Who said we don't get around?

* * *

FROM the looks of things, the private pilot—and that means the enthusiastic unknown out at the Bugle Center airport—is about to get a break. We got a preview look at the advertisement elsewhere in this issue placed by the new Aircraft Owners and Pilots Association. If those fellows do what they say they're going to, the lot of the private pilot in the United States will be far brighter than it ever has been. He'll have an organization that will back him up and protect his interests and will, we hope, do a great deal toward removing the barriers that have held private flying back all these years. It's about time such an organization was formed.

* * *

WE'RE taking a chance on a new little feature this issue. Consequently, we'd like to know what you think of "Have You Seen . . .?" on page 48. In past months we've found ourselves with a bunch of excellent photographs—many of them last-minute scoops—but with no place to put them in the magazine. Now, with two pages devoted to this sort of miscellany, we have a spot for that as-we-go-to-press photo as soon as it comes in. We'd like your opinions.

* * *

THERE'S a humdinger—we think so, at least—coming up for an early issue. It all depends on conditions at Hawaii, Midway, Wake, Guam, the Philippines or even New Zealand. Anyway, one of the transpacific Clipper captains is sandwiching an article for us in between those far-off points. He's promised us the story of a transpacific captain's experiences. So stick around.

* * *

WHEN any man—even the Assistant Secretary of War—is handed $50,000,000 and told to buy some airplanes, that's worth an article in any publication. But Louis Johnson's orders were to spend that money (and there's a hundred million or more still coming) for airplanes. Which is right down our runway. We hesitate pointing out that this is another PA scoop, of course, but you know how it is . . .

* * *

We're just modest. M. K.

END

Tin Watchman

(*Continued from page 26*)

stalling the analyzers. One was on Oct. 17, 1937, when a DC-3 with Earl W. Woodgerd at the controls and 18 other persons aboard, clipped the top of a mountain in the Uinta range, Utah, at 10,000. The ship was bound from Cheyenne to Salt Lake.

Although that plane was shattered completely the analyzer was found and the card recovered. It proved that the plane had maintained its cruising height of 10,000 feet since attaining that level shortly after the Cheyenne take-off. This item and other information that became available during the investigation of the crash virtually proved that storm static—the machine had been flying through a snow storm—had drowned out the radio range signals and the plane had been drifted off course some 50 miles and into a group of the highest mountains in that part of the west.

That ship's analyzer card helped company officials set a new schedule of flight operating levels for the western section of their route. The old levels had been from 9,000 to 12,000 feet. The new were fixed at from 11,000 to 15,000 feet depending upon conditions of visibility and weather. These altitudes have been found to be the solution to several problems encountered on the airlines in the past. Practically all of the over American lines have followed suit in boosting their minimum flight levels to altitudes above the highest point in the area.

All in all, however, United Air Lines believes the flight analyzers are a valuable asset. The company at this time is planning to begin testing a more complex analyzer that in addition to showing all that the current ones record, will also keep a constant record of indicated air speed and outside air temperature as well as a constant record of the manifold pressure gauge readings. This last item will provide the engineers with a report on the amount of power taken from the engines at all times. It will show what pilots abuse the engines and which ones "baby" them. This new analyzer also has been developed by the Friez company and by the time you are reading this story the first one will be in the midst of its flight tests.

United still is proud of the fact that it is the first and only company that has its planes equipped with these analyzers. There are indications, however, that the Civil Aeronautics Authority soon may require every scheduled airliner to carry some such recording device from which any flight may be virtually reconstructed.

It looks as though the boys are going to have more and better "lie detectors" in the cockpit with them.

END

This Important Message Exclusively for

AIRCRAFT OWNERS AND PILOTS

THERE is an old saying that Providence helps only those who help themselves. To prompt what otherwise might be a neglectful providence, we pilots and aircraft owners have banded together within an organization of our own, properly called the

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Many vital problems face us now. Progress *must* and *shall* be made towards greater safety, increased landing facilities, low-cost insurance, elimination of high tension lines and obstructions at airports, technical research in improving the performance without increasing the costs of private aircraft, and a complete and informed recognition by the Federal government of the vital needs of our private flying activities.

Only by united and organized co-operation can we hope to protect and promote these interests. The AOPA has been formed to get ACTION. It is sponsored by an imposing list of private flyers and owners who fly as an avocation, not a profession.

The AOPA is continuously at work learning what things are holding private flying back, and is determined to have those things rectified. The AOPA exists under outstanding auspices, soundly financed, operated by a professional staff . . . The AOPA is run *for* flyers and *by* flyers . . . Hence, we must restrict membership exclusively to aircraft owners and pilots who have soloed aircraft.

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September Issue Now On Sale

Who's Who in Aviation

(*Continued from page* 43)

head of American Airlines' operations department. Was born in Franklin, N. H., on July 6, 1897.

DOOLITTLE, JAMES HAROLD. Head of the aviation division of the Shell Petroleum Co. Famed speed and stunt pilot, Doolittle entered aviation in 1918 with the Army. Advanced rapidly in the Army and set several records in distance and speed flights. Widely known for his work on a blind-landing system, and made one of the first blind landings in aviation history. He was born in Alameda, Cal., on December 14, 1896, today holds Commercial License No. 18.

DOUGLAS, DONALD WILLS. The world's largest aircraft manufacturing plant bears his name. Was in the aerodynamics school at M. I. T. in 1914, then became chief engineer of the Glenn L. Martin Co. Formed the Douglas Aircraft Corporation in 1920 and has been president of that concern ever since. He was born in New York city in 1892 and attended the U. S. Naval Academy at Annapolis and the Massachusetts Institute of Technology. Further details will be found in the November, 1938, issue of POPULAR AVIATION.

(To Be Continued)

END

Air Corps Birthday

(*Continued from page* 62)

substratosphere flying, a development which was to win for the Air Corps the Collier Trophy. In that same month, after two years of research, two wholly automatic landings were made through use of radio aids and the automatic pilot.

With this brief and rather inadequate summary of the events of 30 years since purchase by the Army of its first airplane, we have come to today's most important peacetime event in the history of the Air Corps—the launching of a $300,000,000 national air defense program. Contracts for $50,000,000 already have been signed, entirely for combat airplanes and their engines and accessories.

The opening of the fiscal year, July 1, makes available the remaining $250,000,000 of the program for additional airplanes; training of pilots and mechanics and procurement of personnel which will make the Air Corps second only to the Infantry in manpower; construction of new air bases and expansion of research.

Thirty years ago the Army acquired its first airplane—a virtually unknown quantity, with no military equipment and little, if any, real military value. Its incredible, bonus-winning speed was 42 m.p.h.

Today the Air Corps has awarded or is prepared to award contracts which will bring its strength to 6,000 airplanes. At least one of these types is credited with a speed nearly 10 times that of that 30-year-old antique. Our air defense frontiers are about to be extended into the tropics and to the Arctic circle. With research going forward at a greatly accelerated rate, who can foresee what the next few years will bring in the way of improved airplane performance?

As we look back over the first 30 years of military aviation we may well be astonished at the progress which already has been made and the effect it already has had on our daily lives and the affairs of nations. What may not the next 30 years bring?

END

Neglected Amphibian

(*Continued from page* 34)

adequately corrosion-proof his ship for salt water use. Verily, the dural airplane now leads for marine work. The amphibian purchaser then, buys immunity to the weather and built-in resistance to deterioration that the landplane owner does not possess.

Furthermore, the amphibian owner saves materially over the storage and handling expenses of a mere seaplane owner. He eliminates the expense of ramps, special hangars, costly dollies and a special handling crew every time the plane leaves or returns to its base; the 15 per cent cost of feeding that larger motor becomes cheap in comparison. It is easy enough to find an airport where the amphibian may be permanently based and serviced at standard rates, ready to fly direct to lake or shore. And, when a long trip is planned, how easy it is to land at airports for fuel and lunch even though the route lies along a coast—and how hard to find and get that fuel aboard when flying a pure seaplane.

We close with a plea for more amphibians of all sizes, particularly in the two- to four-place class—and a forecast that they will soon appear. We made that forecast 14 years ago, so we must be nearer the truth now than ever!

END

What Caused Them

OF 306 non-airline accidents recently reported upon by the Air Safety Board of the Civil Aeronautics Authority, 64 involved engine failures. In 28 of the engine failures three was evidence definitely indicating improper operation, servicing or maintenance as the cause, while only 12 were definitely attributed to mechanical failure. The other 24 engine failures were ascribed to causes that could not be definitely attributed to either human or material factors, or were of an undetermined nature.

The failures involving human factors included: seven cases of fuel exhaustion, five cases of water in the fuel, five cases of clogged fuel lines, five cases in which it was evident that the pilot had allowed the engine to become too cool during a glide—including two cases in which inferior fuel had been used; two cases of improper lubrication; and there were single cases involving failure to turn the gas on, a loose spark plug, loss of water due to a leaky cooling system, and an open fuel strainer valve.

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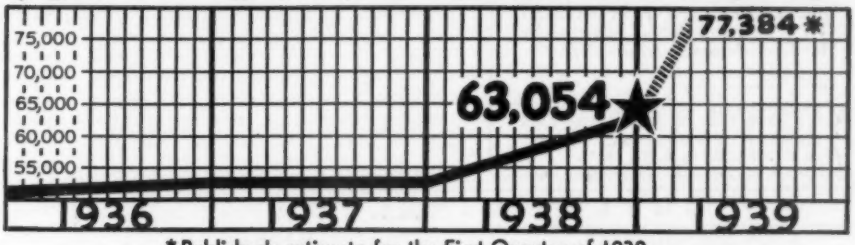

*Publisher's estimate for the First Quarter of 1939.

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Synthetic Aviation Fuels

by James P. Eames

HUNCHED over the controls of his 2,000 h.p. pursuit airplane an American military airman annihilates space spanning the continent in practically seven hours flat. Far out at sea, a *China Clipper* roars unerringly across the boundless expanse of restless, tumbling ocean. On the Atlantic coast a Navy fighter screams downward in a breathless power dive, faster than a human being has ever traveled before. What does all this mean?

Simply this: that with the ever-increasing demand for greater speeds and bettered performance in both commercial and military airplanes, the aircraft engine manufacturers have labored desperately—and with remarkable success—to produce marvels of mechanical efficiency. Our present power plants of enormous output weigh but very little more than one pound for each unit of unleashed horsepower. Gigantic, shiny monsters, they have—both radial and inline—contributed enormously to the recent progress in aeronautics, keeping step right along with the marvelous advances in airplane structural engineering. But this notable work could not have possibly succeeded to the extent that it has to date without commensurate strides in the development and production of suitable aircraft engine fuels.

We have long since become accustomed to the magic of ethyl gasoline and the mysteries underlying "knocks" and the detonating characteristics which appeared as the compression ratios of aircraft power plants swerved upward. We no longer gasp at the mere mention of 100 octane aviation gasoline. But all the while the major oil companies have been on the alert, consistently studying the needs and requirements of the aeronautical industry. Now they have come forward with a brand-new ace-in-the-hole—synthetic aircraft engine fuel.

In the course of the gasoline cracking operations which are performed at the larger petroleum refineries, certain gaseous by-products are developed and released. The magic wand of chemistry is waved over one of the commonest of available materials, natural gas, and this lowly substance is transformed into crude hydrogen gas. Later it will be compounded with these gaseous by-products. The resulting product is a highly-refined, synthetic iso-octane that is capable of being blended with standard aviation gasoline stocks.

But, in keeping with the age-old statement that "there is nothing new under the sun" let us, in our imagination, look into a small chemical research laboratory just outside of Paris, France. The time is the latter part of the 19th Century. Two bearded French scientists are bending over a test tube from which a faint trickle of grayish vapor is emerging. Intently they study its contents. Despite their comparatively youthful appearance these two men—Sabatier and Senderens—are included amongst the most eminent technicians and scientists of Europe at this time. Suddenly, with true Gallic enthusiasm, they shout joyfully and embrace each other. Their long, painstaking researches have proved successful. They, working together, have accomplished the combination of hydrogen gas with certain of the inorganic chemical compounds. After lengthy and arduous researches, they found that this combination could occur only when the treatment was effected in the presence of suitable "accelerators" which are designated by the technical chemical term of "catalysts". Immediately following this noteworthy discovery, marvelous advances in the field of chemistry and chemical engineering were accomplished. One notable advance directly attributable to this work—the effects of which are still being felt at the present time—lies in the conversion of vegetable oils to the fats which are employed in every American household for ordinary cooking purposes.

The catalysts or accelerators employed in these original experiments consisted

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of finely divided metals such as platinum and nickel. The treatment of gasoline stocks must of necessity be directed along somewhat different lines of attack. Unfortunately, the metallic catalysts are extremely sensitive to the presence of the local impurities commonly found in the ordinary gasoline blends. The worst of these impurities, as far as its effects are concerned, is sulphur. The presence of this element represents a condition sufficiently severe to cause the metallic catalysts to become completely inactive during the process of hydrogenation. In technical chemical language the sulphur is said to "poison" the metallic catalysts.

If this were not the case, we probably would have had our hydrogenated aviation fuels considerably sooner than this. However, chemical engineers have been laboring for many years to produce catalysts which would be immune to sulphur corrosion. Only recently have their painstaking researches been brought to a successful conclusion. A further engineering problem is presented, however, in view of the fact that these sulphur-resistant catalysts function properly only in the presence of high pressures when applied to petroleum refining processes.

Recently the Standard Oil Company of California installed a huge synthetic fuel blending plant—or, as it is termed in plant parlance a "hydro plant"—in its main refinery at Richmond, Cal. Thus, the long-awaited advent of hydrogenated aviation fuel will shortly become a definite reality.

The steps underlying the production of hydrogenated aircraft engine fuel are outlined below. Live steam is driven into a mixture of natural gas compounded with a suitable catalyst. In this manner hydrogen gas is initially generated. A bad feature of this process is involved in the fact that considerable quantities of death-dealing carbon monoxide is necessarily present as a result of this combination. Obviously, this lethal element must be removed. This is accomplished by introducing other catalysts which function in the conversion of carbon monoxide to carbon dioxide to the mixture along with a jet of additional steam. The carbon dioxide is finally removed by treatment with a chemical reagent which bears the long, formidable name of monoethanolamine. Upon the completion of this process only the pure hydrogen remains. The purified hydrogen gas now is piped to three steam-driven compressors. Passing through these devices, the material is finally delivered at the enormous pressure of 3,500 pounds per square inch.

By this time the purified, compressed hydrogen gas has become available for the reaction with the raw material employed in the manufacture of the commercial iso-octanes. This raw material is developed from the unsaturated gases which are formed as a by-product and remain after the various gasoline cracking operations have been completed, as mentioned previously in this article. To again refer to our glossary of technical petroleum engineering terms, this last-

(*Continued on page* 89)

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WANTED: Gas tank for Gypsy Moth, George Petron, Pierre, S. Dakota.

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WANTED one left wing for Nicholas Beazly 8, also prop. for Genet engine. Pete Smith, 4445 Laclede, St. Louis, Mo.

WANTED: 1935 Aeronca C-3 parts, cabane exhaust assembly, ailerons, fuselage parts. State price and condition. Ray Wolski, 10300 Burin Ave., Inglewood, Calif.

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PATENTS

PATENTS: Low cost. Book and advice free. L. F. Randolph, Dept. 372, Washington, D. C.

Aviation Fuels

(*Continued from page 87*)

mentioned material is called a synthetic "polymer".

The actual combination between the purified hydrogen gas and the gasoline polymers is accomplished in an apparatus which is designated as the reaction oven. Picture a huge cannon which has a barrel 40 feet in length, an inside diameter of three feet and walls of several inches in thickness. Arrange this giant cannon vertically so that it points straight up at the sky and you have the reaction oven required for this process.

Following this treatment, the mixture of hydrogenated product and excess hydrogen gas is discharged from the reaction oven. The pressure still is maintained at a high value, being at this phase of the process approximately 3,000 pounds per square inch. The entire mixture is now passed through an elaborate cooling and condensing system wherein the vaporized products are liquefied. The purpose of this step in the process involves the complete separation of the gaseous and liquid elements. This being accomplished, the excess gas is again directed back into the reaction oven.

The process is now completed. Its ultimate product is a highly-refined commercial iso-octane ready as it stands for blending with standard aviation gasoline stocks in order that the finished product thus obtained will meet Government specifications underlying such items as vapor pressure and distillation range. In this manner, anti-knock and performance characteristics comparable to the best existing aviation gasolines are secured. Theoretically, these include the possession of an octane rating number of 93 and, it is claimed, a flash point which is maintained within the conservative value of 127 degrees Fahrenheit. Notwithstanding this safety characteristic, hydrogenated aviation fuel is capable of being employed with values of compression ratio as high as 7.5 to one.

There is, of course, a certain amount of hazard involved in the actual production of hydrogenated aviation fuel blends. For instance, an explosive mixture occurs whenever the oxygen content attending the processing of the gaseous hydrogen products attains a value of two per cent. Any possibility of this occurrence attaining dangerous proportions is prepared for by means of the installation of suitable alarms. These precise devices permit the oxygen content to reach only one-tenth of the above-mentioned value before they come into operation. In addition to this precaution, inert, noncombustible gases are manufactured in order to assist in the removal of all explosive gases from the plant in the event of trouble. In any extreme emergency, the hydrogen and oil content of the entire hydrogenation system can be vented to the atmosphere through a specially designed release stack which is equipped with an automatic water spray.

The attached glossary of petroleum engineering terms might prove useful to the reader.

Cracking: All petroleum products are essentially hydrocarbons, that is, chemical compounds containing hydrogen and carbon in various proportions. In the process of refining petroleum, the decomposition of the higher hydrocarbon compounds of the material is termed "cracking". Cracked gasolines are not ordinarily employed for aviation purposes since their gum content is usually in excess of that permitted.

Fractional Distillation: This process consists in separating the crude petroleum into parts or fractions all of which differ from each other in their boiling points. This is done by distilling the original mixture and collecting separately parts of the distillate. Aviation gasoline is usually manufactured in this manner.

Flash Point: This is the value of the temperature at which a gasoline or lubricating oil will give off sufficient vapors to cause the material to flare or flash momentarily when brought into contact with an open flame.

Iso-Octane: One of the higher hydrocarbons which possesses a high degree of resistance to detonation or extremely rapid combustion. This characteristic makes it valuable as a yardstick for the determination of the anti-knock performance of gasolines. Detonating or, as it is popularly known, "knocking", is to be avoided in aviation gasolines since it causes excessive heating of the cylinder and piston units. As the compression ratio of an engine is increased, detonating characteristics increase in proportion.

Octane Rating: This is a comparative measure of the anti-knock characteristics of a gasoline fuel blend. The knock resisting qualities of an expensive iso-octane compound is tested and recorded. When a tested gasoline attains an equivalent performance it is assigned a similar anti-knock rating. For instance, 87 octane aviation gasoline possesses an anti-knock performance similar to that of a basic non-detonating fluid containing 87 percent iso-octane by volume. Aviation fuels are most generally doped with tetraethyl lead to obtain desired anti-knock characteristics. This is "ethyl gas".

Polymers: The raw materials which are developed from the unsaturated gases which are formed as a by-product during the course of gasoline cracking operations.

END

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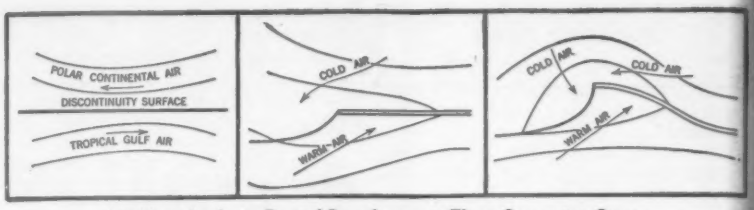

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